TECHNOLOGY DEPT.

Gas Journal

INSTITUTION NUMBER

VOL. 282. 107th YEAR. LONDON, JUNE 8, 1955 No. 4801. PRICE 2/6

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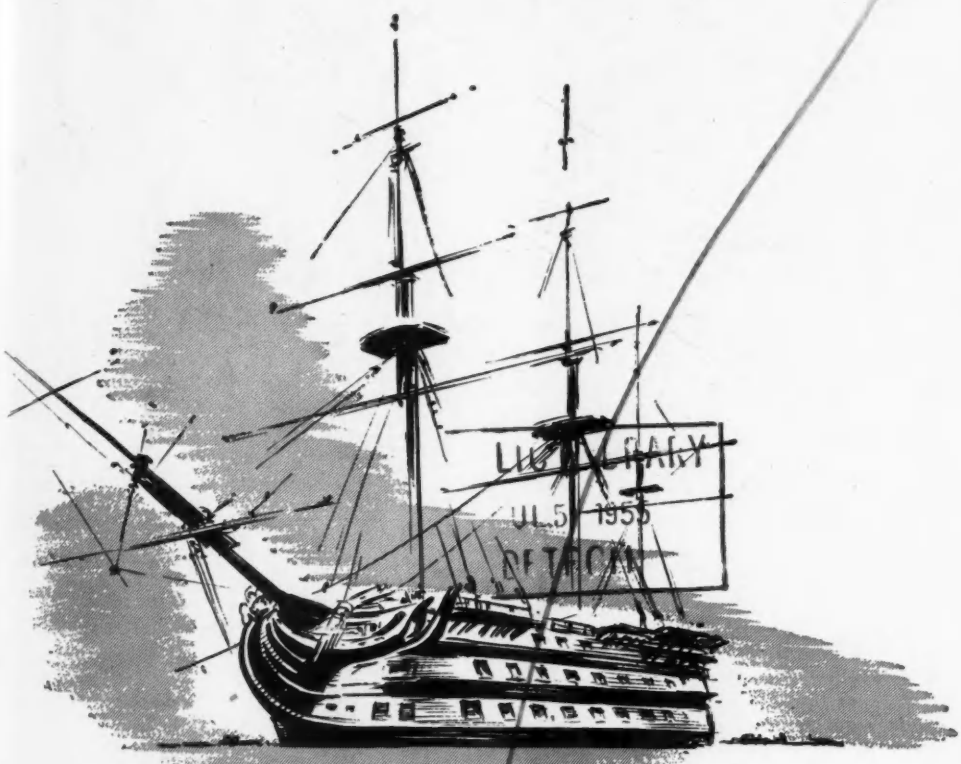

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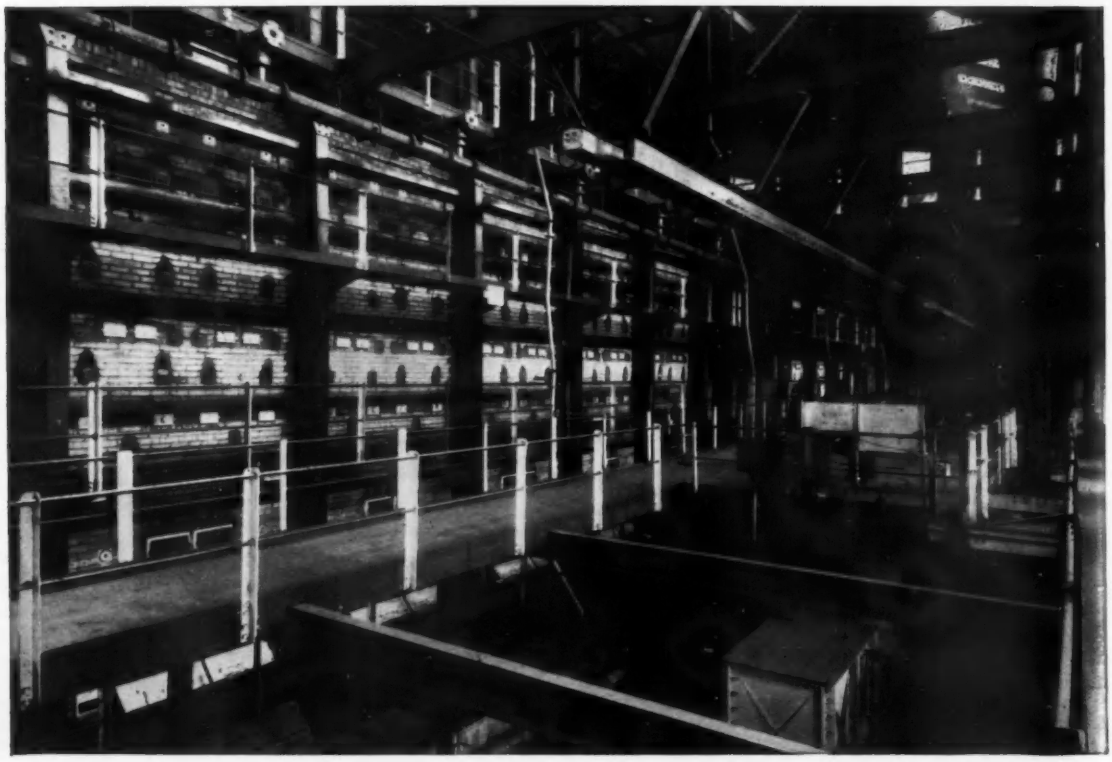
View showing the two Benches of 6 Settings of 4 Retorts. C.O. Main can be seen in the foreground. MANCHESTER — Bradford Road Works.

Unretouched photograph published by the courtesy of the North Western Gas Board.



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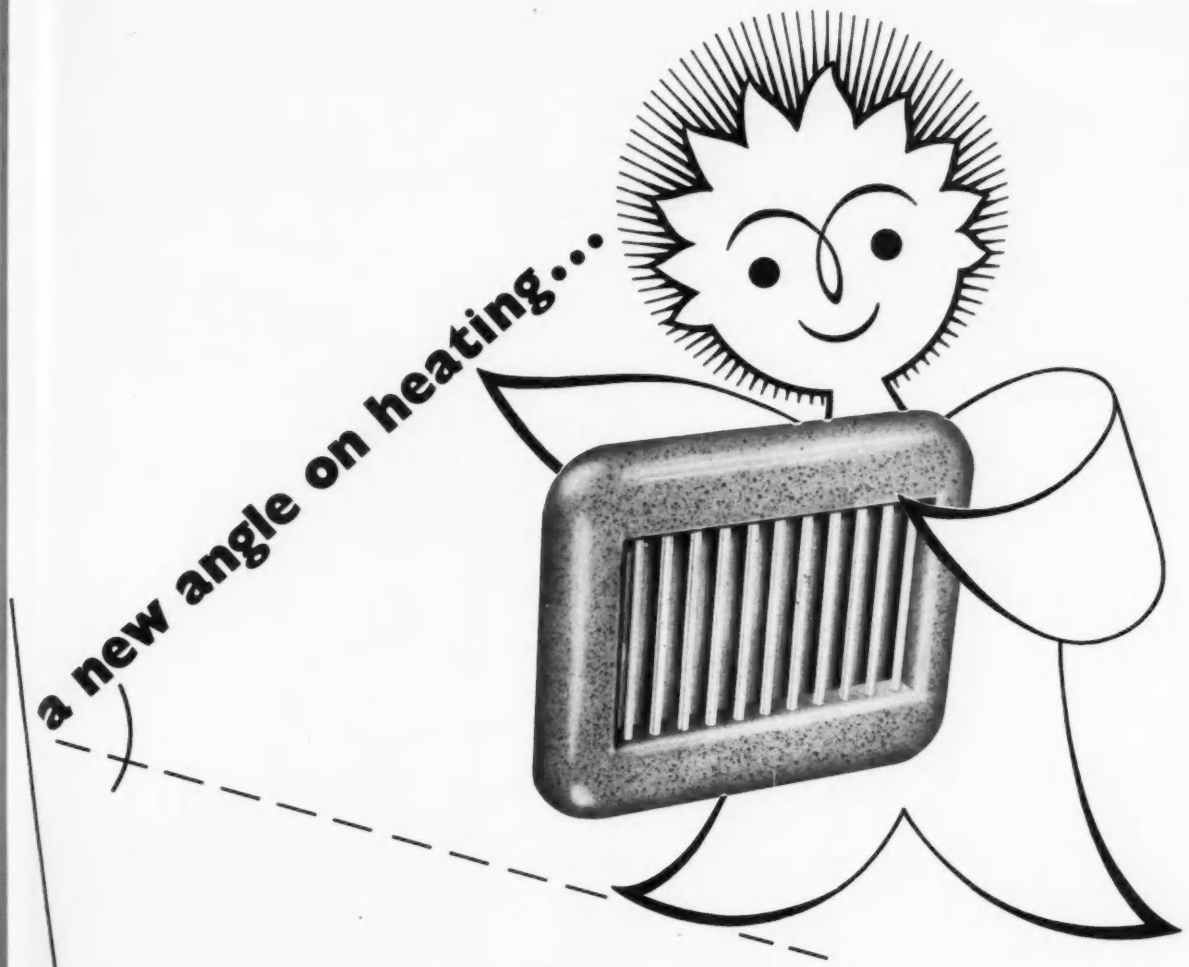

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Photograph by courtesy of Southern Gas

New three-lift Spiral-Guided "FB" Gasholder in Steel Tank 1,000,000 cu. ft. capacity, provided with "Vulcan" cup and dip stiffeners, "Vulcan" ball-thrust guide carriages having cast steel bodies and grease gun lubrication. Built for the Southern Gas Board at the New Central Gas Works, East Cowes, I.O.W.

Two further Gasholders are shown in the course of erection a double-lift Column-Guided C.W.G. Holder, and a 750,000 cu. ft. three-lift Spiral-Guide Holder of similar design to the 1,000,000 cu. ft. Holder just completed.

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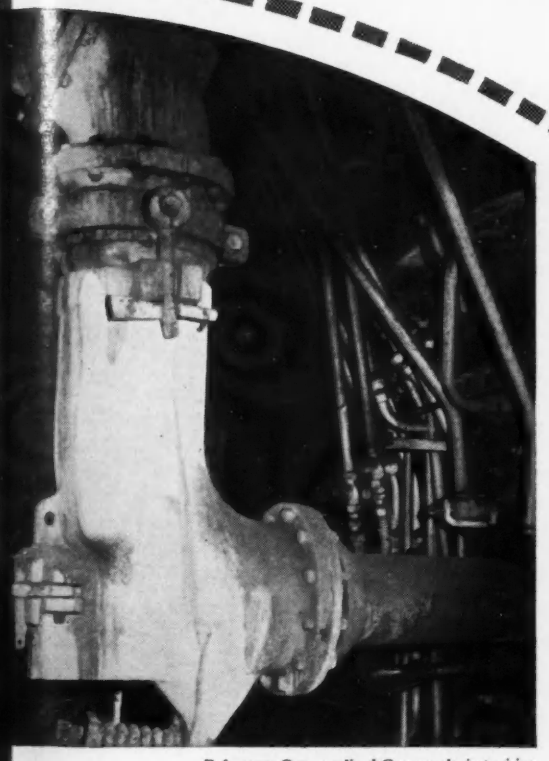
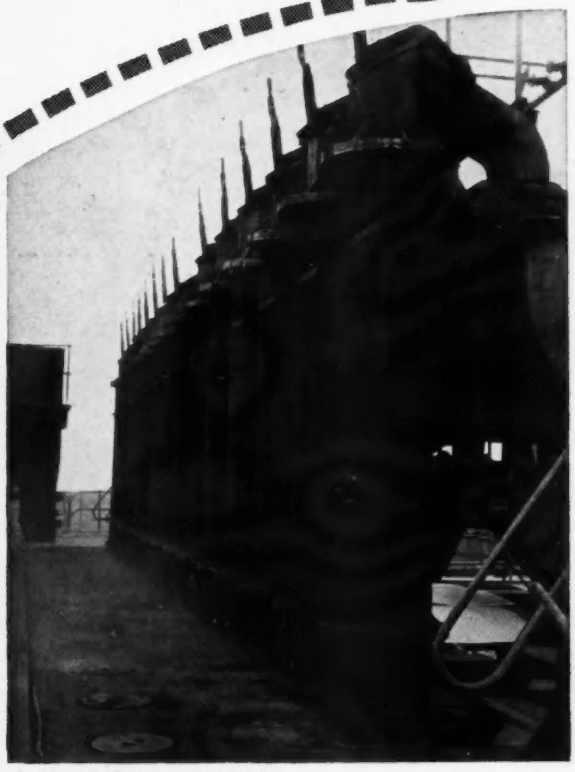


Refractory Concrete-lined Goose necks in position on blast furnace from bustle pipe to tuyere



A battery of refractory-concrete-lined ascension pipes in service.

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Coke oven ascension pipes showing Refractory Concrete lining.

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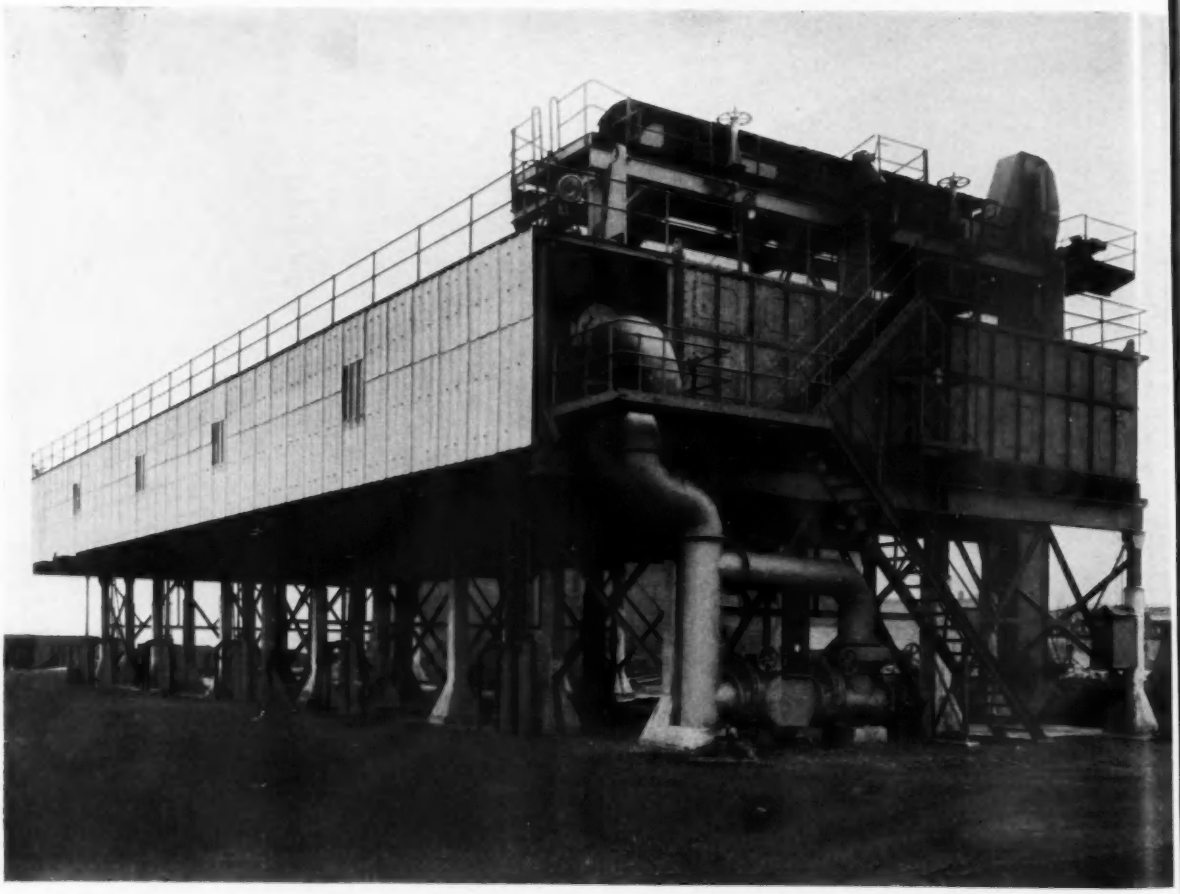

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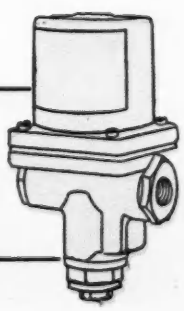

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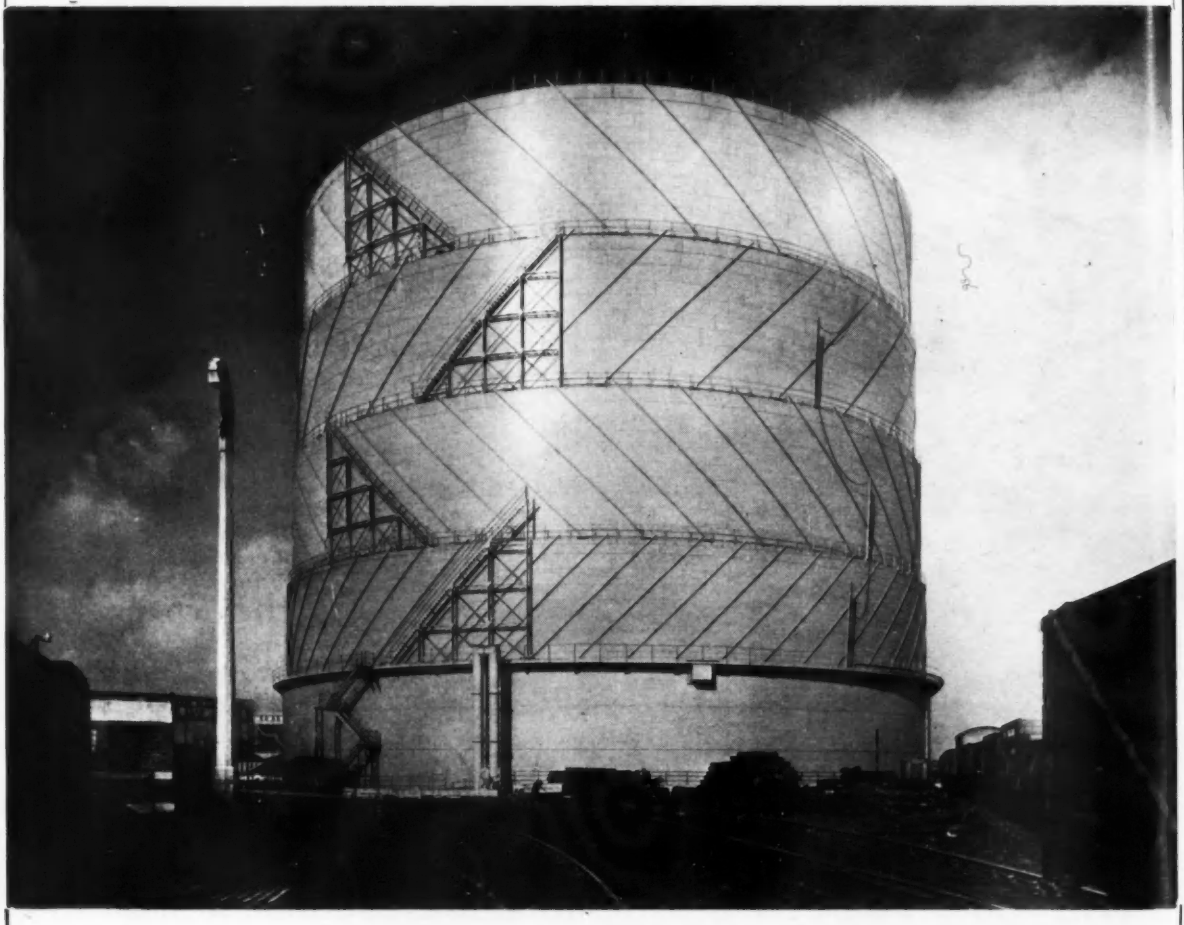

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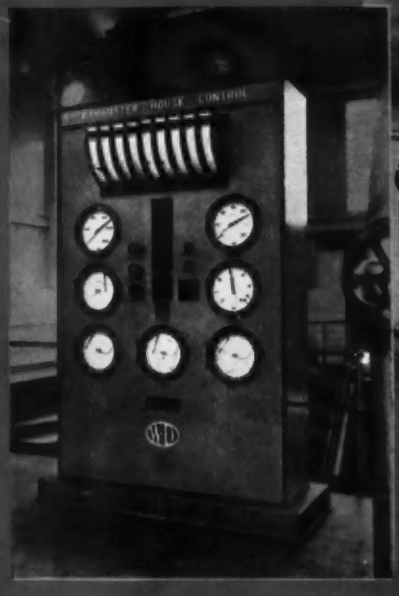

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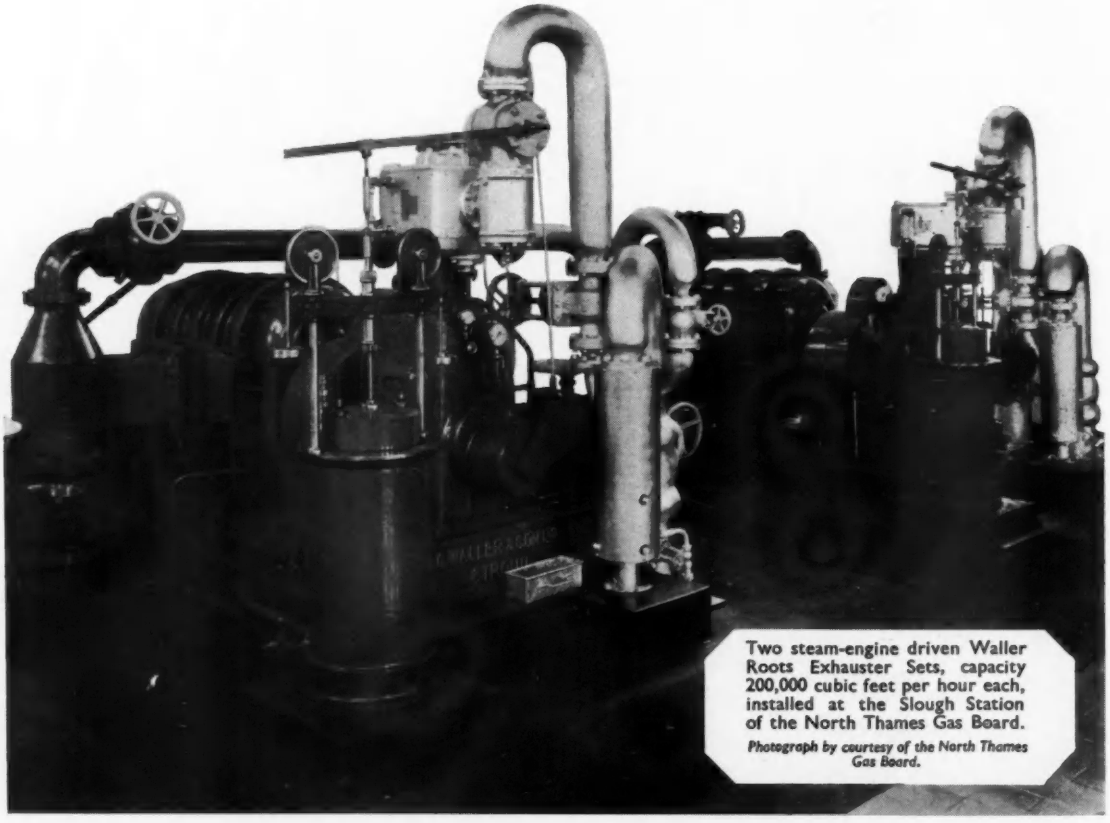

Two steam-engine driven Waller Roots Exhauster Sets, capacity 200,000 cubic feet per hour each, installed at the Slough Station of the North Thames Gas Board.

Photograph by courtesy of the North Thames Gas Board.

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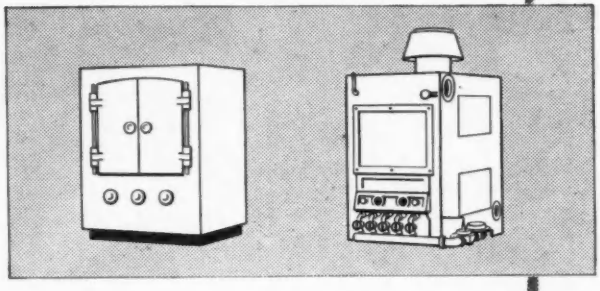

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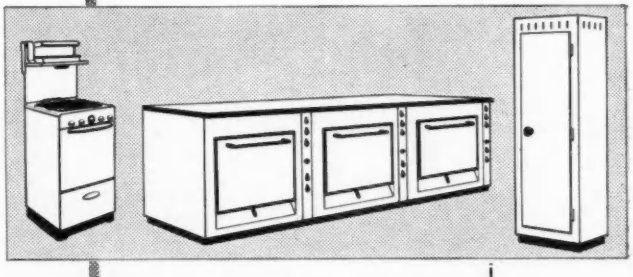
that spells efficiency–



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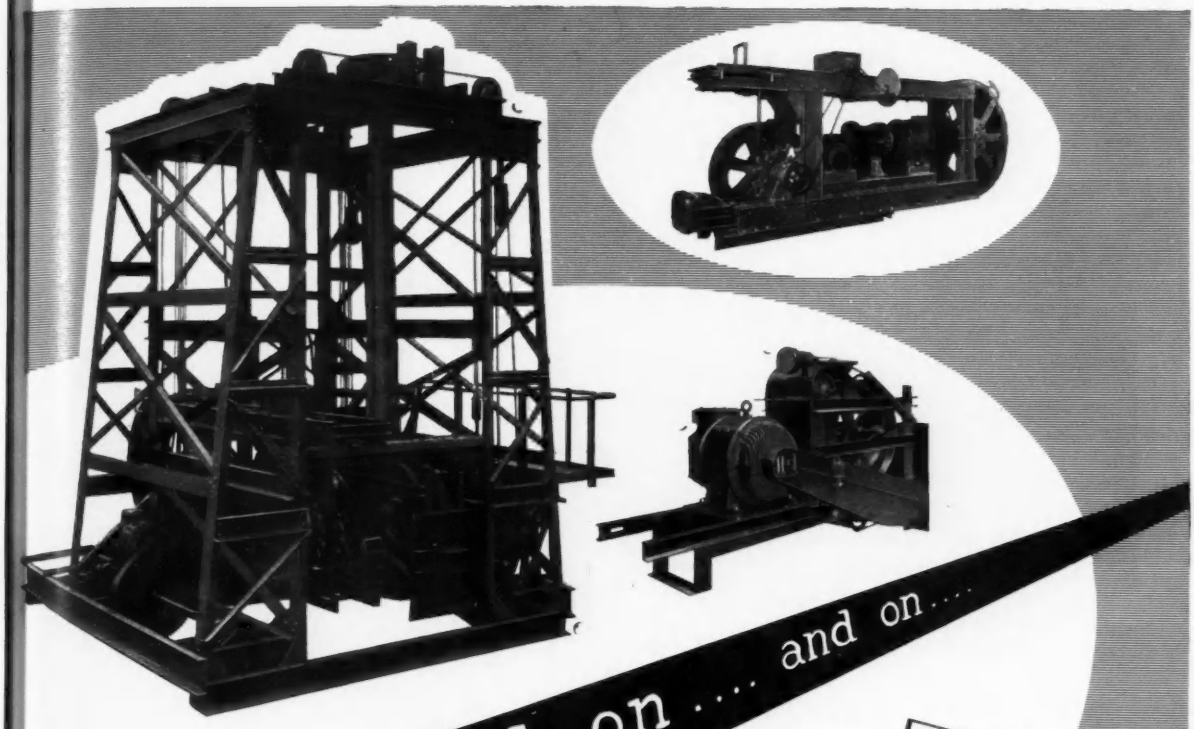

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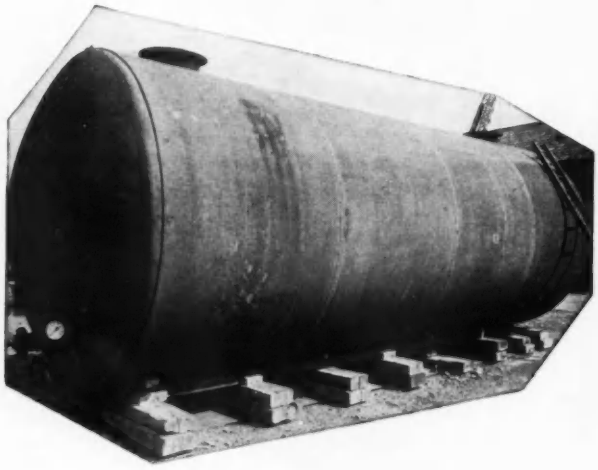

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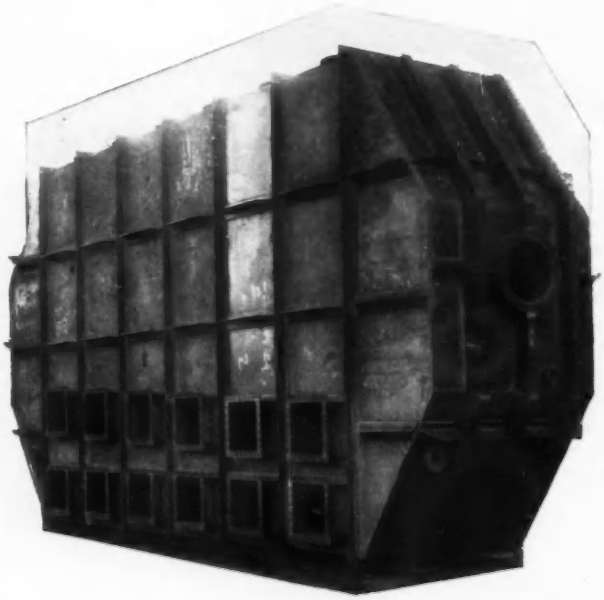

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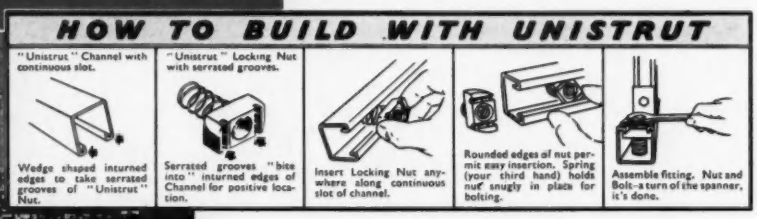
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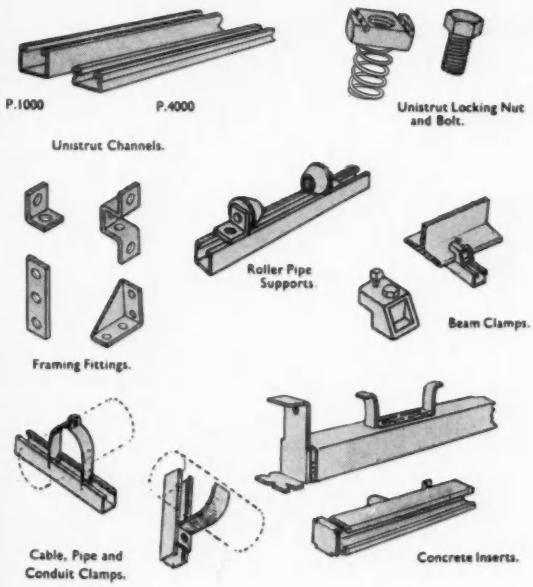

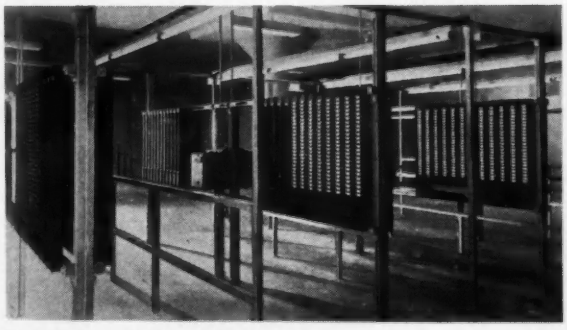

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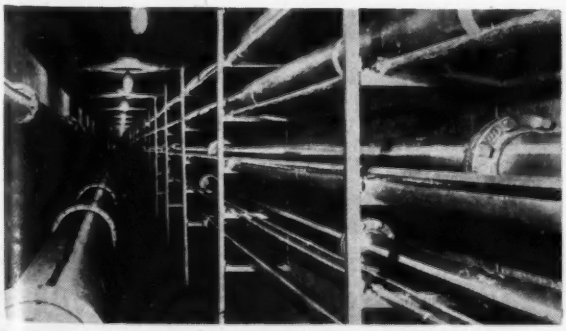

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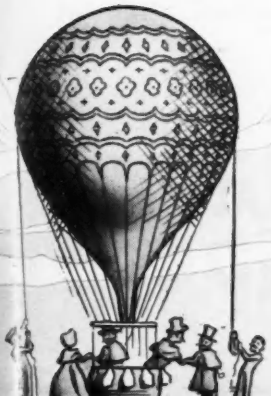

This coin plate has a setting range of 12 to 312 cu. ft. per shilling. A distinct advantage is the use of a single slot, through which both 6d. or 1/- coins, or both, can be taken by a simple adjustment of a clearly marked bracket located at the rear of the coin plate. The facilities for optional setting are clearly marked and the satin chrome and black finish on the embossed index plate is both attractive and durable. An ingenious cam action on the coin plate tends to draw the coins into the pocket.

George Wilson Gas Meters Ltd.,

COVENTRY · JARROW · LONDON · MANCHESTER · WOLVERHAMPTON · GLASGOW

THE VITAL FLAME OF PROGRESS

Photograph by courtesy of the Gas Council.

FREDERICK WINSOR 1763-1830

Born in Brunswick, he came to England about 1803 and became the "business impressario" of the infant gas industry.

He is best remembered for his first public gas lighting display at Carlton House and along Pall Mall.

For many years Staveley pipes have been recognised the world over as of the highest attainable standard for Gas mains.

SAND & METAL SPUN PIPES FOR GAS

THE STAVELEY IRON & CHEMICAL CO. LTD. NR. CHESTERFIELD

The Season's Cooker

You always get the best out of a...

NEWHOME

MODERN GAS COOKER

model no. X2

STOVES LTD

RAINHILL LIVERPOOL

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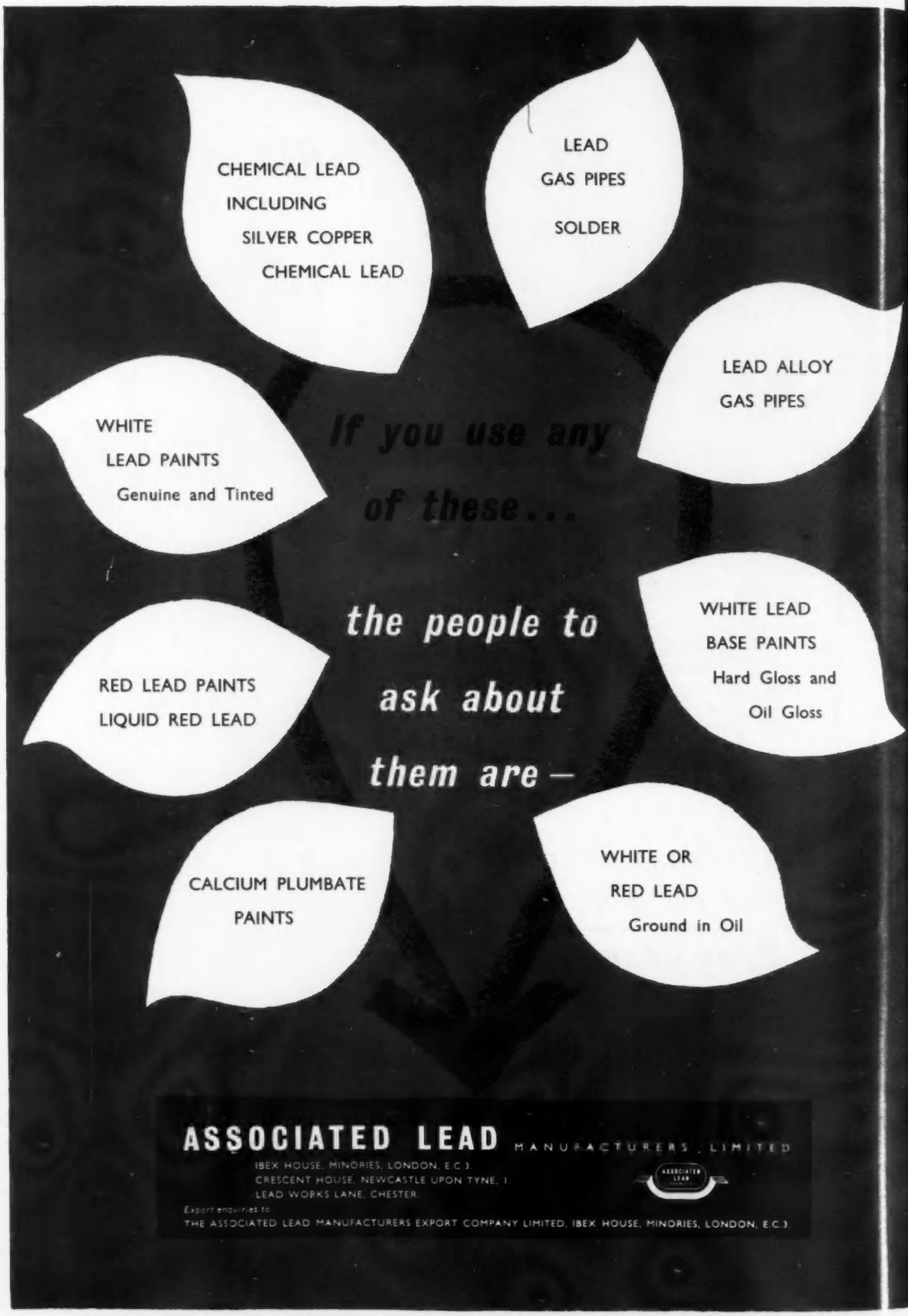
CHEMICAL LEAD
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GAS PIPES
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LEAD PAINTS
Genuine and Tinted
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the people to
ask about
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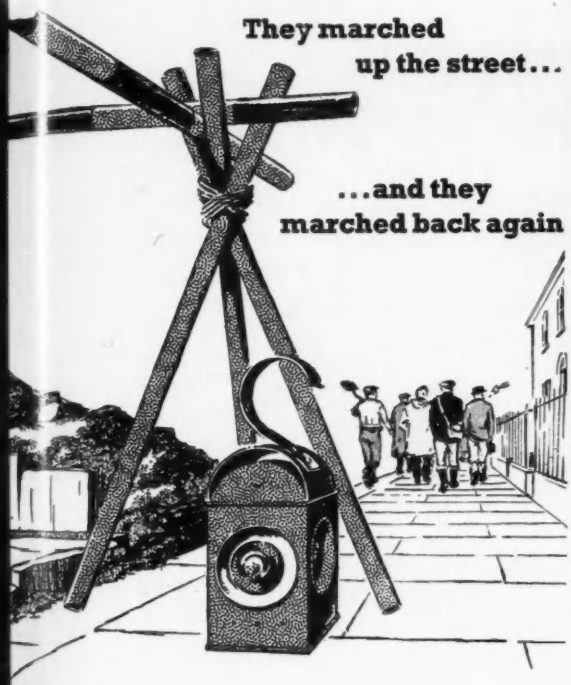

They marched up the street...

...and they marched back again

ow often it has happened. A leak detected . . . the
ench left open . . . waiting for leak clamps to be delivered
r fitting. Little wonder that progressive undertakings
day insist upon testing and repair
ngs carrying C.P. Leak Clamps with their equipment.
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peration . . . *permanently* repaired because flexibility in the
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These wasted man-hours can be saved by stocking CP Leak Clamps

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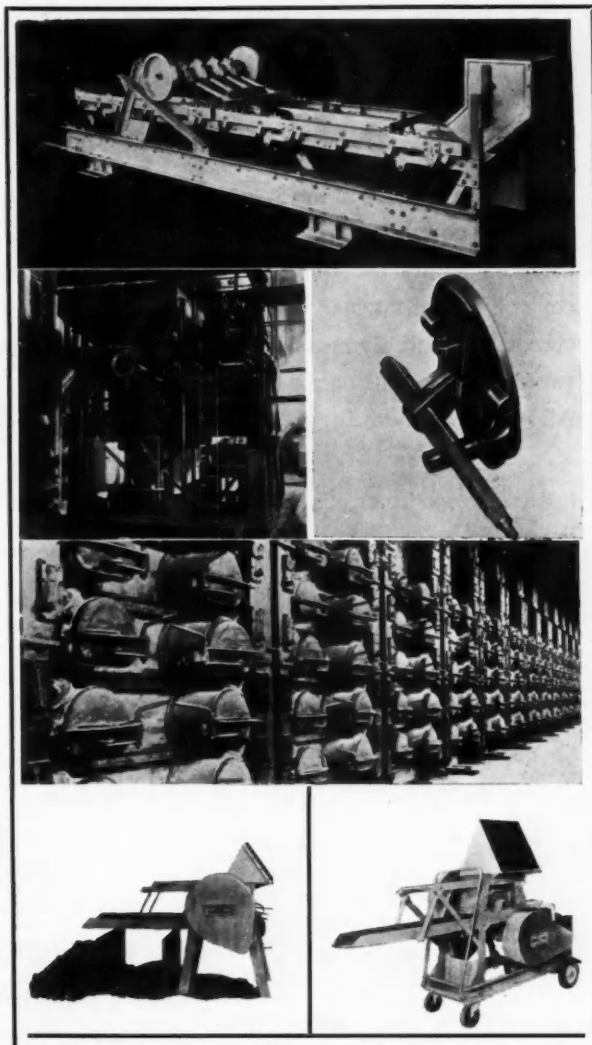

1. 25 tons per hour A & G Screen.
2. Multiple Stroke machine and Retort Bench fitted with Congdons.
3. Latest type of Congdon Valve (Patented).
4. A Congdon installation.
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ALDRIDGE & RANKEN LIMITED

AVONBANK WORKS, BATH

Tel.: 2936 & 5711

the last word in gas installations

REMOTE CONTROL

makes gas distribution a one man job!

The district stations in the Southern Group of the Central Division, Southern Gas Board, are remotely controlled from a room at Aldershot. The remote control scheme has been designed jointly by Automatic Telephone & Electric Co. Ltd., who supplied the remote control equipment, and the Bryan Donkin Co. Ltd., who supplied the governors, valves, compressors etc. By means of a single pair of telephone wires to each district station, or to two district stations on a party line basis, e.g., Bordon and Alton, this equipment provides all the following facilities:

(*a*) Remote indication of pressure at inlet to volumetric governor.

(*b*) Remote indication of flow through volumetric governor into station.

(*c*) Remote control of flow into station.

(*d*) Remote indication of gasholder stocks, with audible and visible alarms for high and low limits.

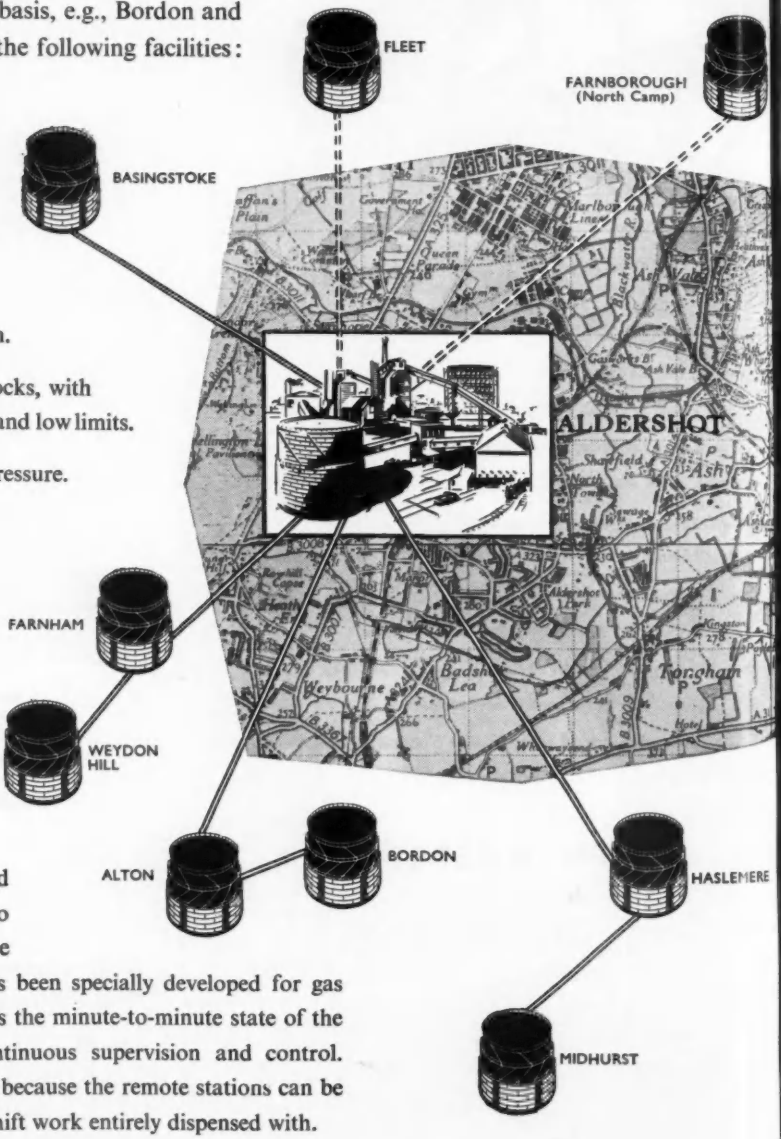
(*e*) Remote indication of the district pressure.

(*f*) Remote control (start/stop) and indication (running/stopped) of the station booster.

(*g*) Remote indication and alarm of electricity supply failure.

(*h*) Equipment testing facilities.

(*i*) Telephone communication.



Supervisory Remote Indication and Control Equipment can be applied to interlinked schemes of any size. The equipment employed at Aldershot has been specially developed for gas distribution control and its use enables the minute-to-minute state of the distribution system to be under continuous supervision and control. Saving of man-power is considerable, because the remote stations can be left unattended for long periods and shift work entirely dispensed with.

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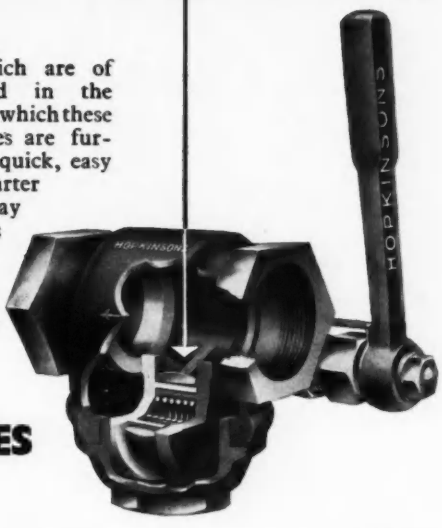
Telephone: TEMple Bar 4506 Telegrams: Strowger Estrand London Strowger Works, Liverpool 7
THE BRYAN DONKIN CO. LTD. CHESTERFIELD
AT 45: 2-A23

The secret is in the seating . . .

and valve parts, which are of 'Platnam' alloy, and in the parallel-slide action with which these Hopkinsons' Link Valves are furnished. Fluid-tightness; quick, easy operation by less than a quarter turn of the handle; full-way passage and other features make the valve capable of a very wide range of duties - for steam, water, air, oil, or thick heavy fluids. Write for Catalogue 951 - 'Bronze Valves'

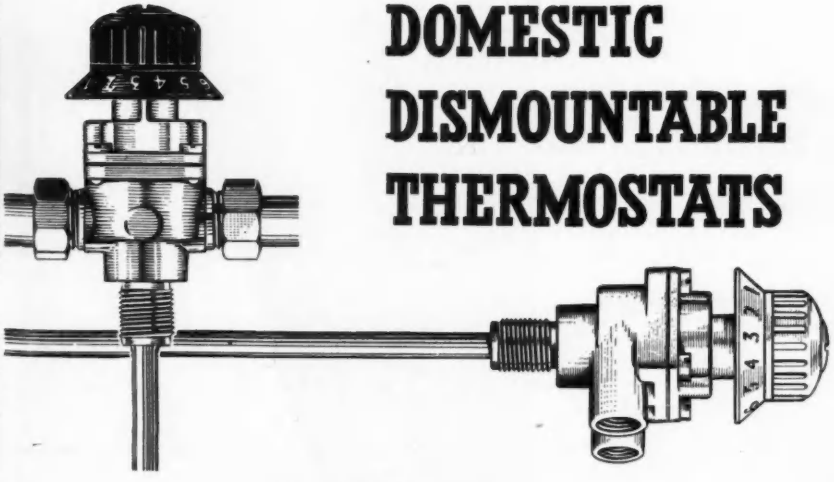


HOPKINSONS' BRONZE VALVES

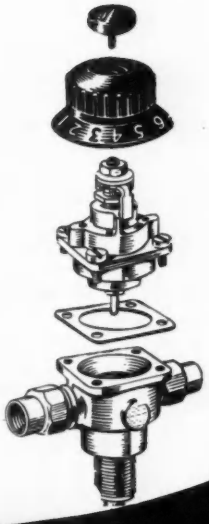
HOPKINSONS LIMITED · HUDDERSFIELD

LONDON OFFICE: 34 NORFOLK STREET · STRAND · W.C.2.

HV 66



DOMESTIC DISMOUNTABLE THERMOSTATS



Domestic Dismountable Thermostats

Extreme simplicity and economy.
Completely redesigned with streamlined dismountable valve assembly, and small dimension body. Patterns available for iron pipe, copper tube and Bundy tube connections.
Interchangeable models for coal gas and Butane burning appliances.
Dials available calibrated to B.S. 1250, calibrated in Fahrenheit or centigrade degrees and lower temperature ranges for water boilers. Colours to suit all schemes. Engraving for front or side mounting.
Fixed or variable by-pass.
TR. 536 Coal gas thermostats with straight through connections on body.
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TR. 541. Coal gas thermostats with "U" type connections.
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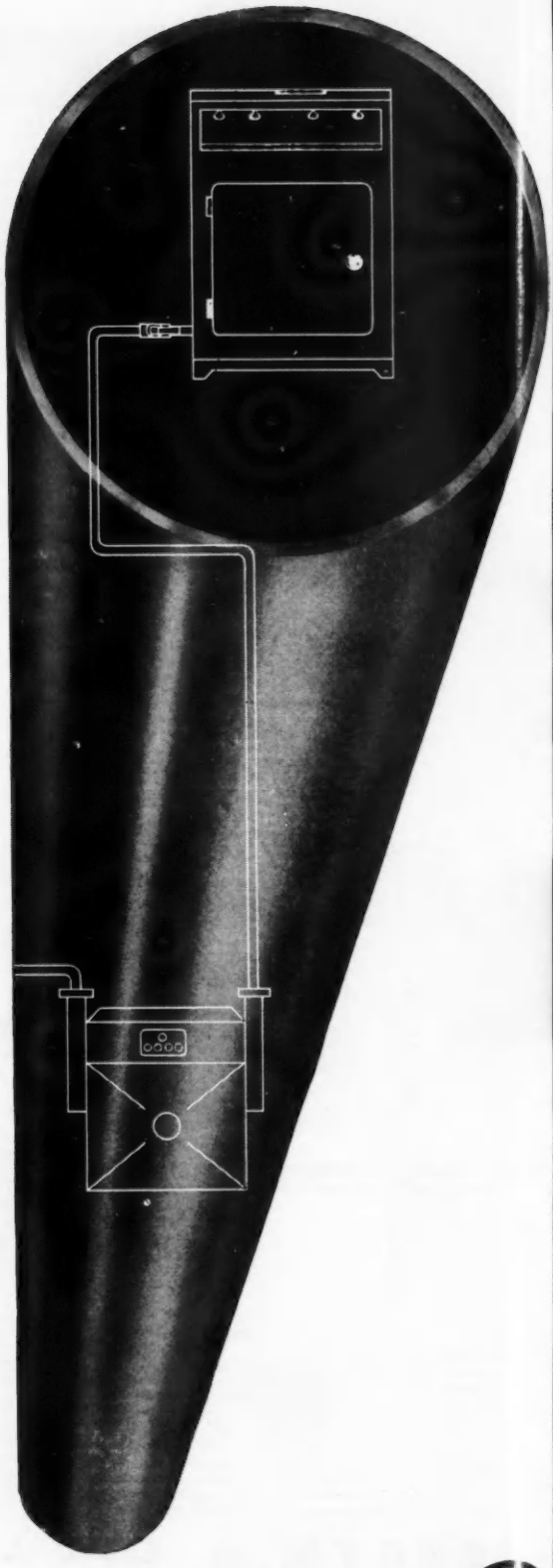
MOORSOM STREET, BIRMINGHAM, 6. Telephone: ASTON CROSS 4011 (5 lines)

London Address: 23, Great Suffolk Street, S.E.1. Telephone: WATerloo 6418

I.C.I. Copper tubes for trouble-free Gas Systems



For domestic gas systems, light gauge copper tubes made by the Metals Division of I.C.I. have five obvious advantages. They are:—

1 **Economical, both in laying costs and maintenance.**

2 **Not attacked by normal town gas.**

3 **Easily manipulated and installed.**

4 **Strong in relation to their light weight.**

5 **Neat in appearance.**

Whatever the building—farmhouse or factory; house, hotel or hospital—the job is better done with I.C.I. copper tubes.

IMPERIAL CHEMICAL INDUSTRIES LTD LONDON SW1

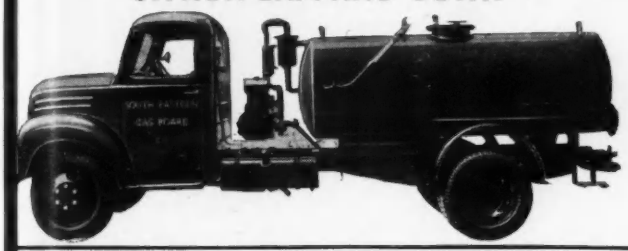
Fittings for copper tubes are made by Fyffe & Co. Ltd., Dundee, a subsidiary company of I.C.I.

LEANING BLOCKED SERVICE PIPES METHODS REVOLUTIONISED BY

ALLAN TAYLOR SERVICE PIPE CLEANING OUTFIT

The 75 gallon Allan Taylor pressure/vacuum service cleaning equipment is simple in with exhauster which can be used for vacuum or pressure. Normally used as a trailer unit and towed by a 10 cwt. van. Clearly seen (centre in photograph) are the cyclone and test bar. This additional equipment enables the operator to make pressure tests before and after cleaning the service pipe, the test taps passing 50 cu. ft. or 100 cu. ft. as required. By passing the Cyclone the dust drawn from the service pipe is deposited in the sight glass for inspection and can then pass into the easily removable container below. The arrangement further enables the operator at the machine to determine whether or not there has been any success with a cleaning operation. The extractor also prevents the greater part of the rust dust from entering the 75 gallon cylinder.

SYPHON EMPTYING OUTFIT



The Vacuum Syphon Emptying Outfit illustrated is mounted on a 4 ton **Thames** Chassis. A 600 gallon galvanised tank is fitted. A rotary type exhauster is driven by a 4 b.h.p. four-stroke air cooled engine, mounted on a sub-frame behind the cab. The tank is fitted with a flame-proof vent and the outfit can be used for high or low pressure syphon emptying. A large manhole at the rear allows the tank to be cleaned easily. A sight glass is fitted to enable the operator to know when the Syphon is emptied. Twenty-five feet of 1½ in. suction hose is supplied with the outfit. The outfit can be used for vacuum or pressure working.

ALLAN TAYLOR (ENGINEERS) LTD.

WANDSWORTH HIGH STREET, LONDON, S.W.18 *Telephone: VANdyke 4433 (five lines).*

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THE WATERFLOW CALORIMETER FOR YOUR LABORATORY

Specially designed for use on retort, producer, water, natural and oil gases, the SIGMA Waterflow Calorimeter incorporates many valuable features.

Spot tests can be conducted within 20 minutes, including the setting up of the instrument.

Immune from any necessity to adjust the water level of the holder.

Gases from 90 to 2,000 B.Th.U. or Calorie equivalent can be tested.

Mahogany cabinet is available where portability is desirable.

Accessibility of the water space for cleaning (invaluable when hard water is used).

These features, plus SIGMA accuracy and dependability, make the No. 15 Waterflow Calorimeter a first choice in your laboratory.

For further details write to :—

THE SIGMA INSTRUMENT CO. LTD.

SPRING ROAD, LETCHWORTH, HERTS.

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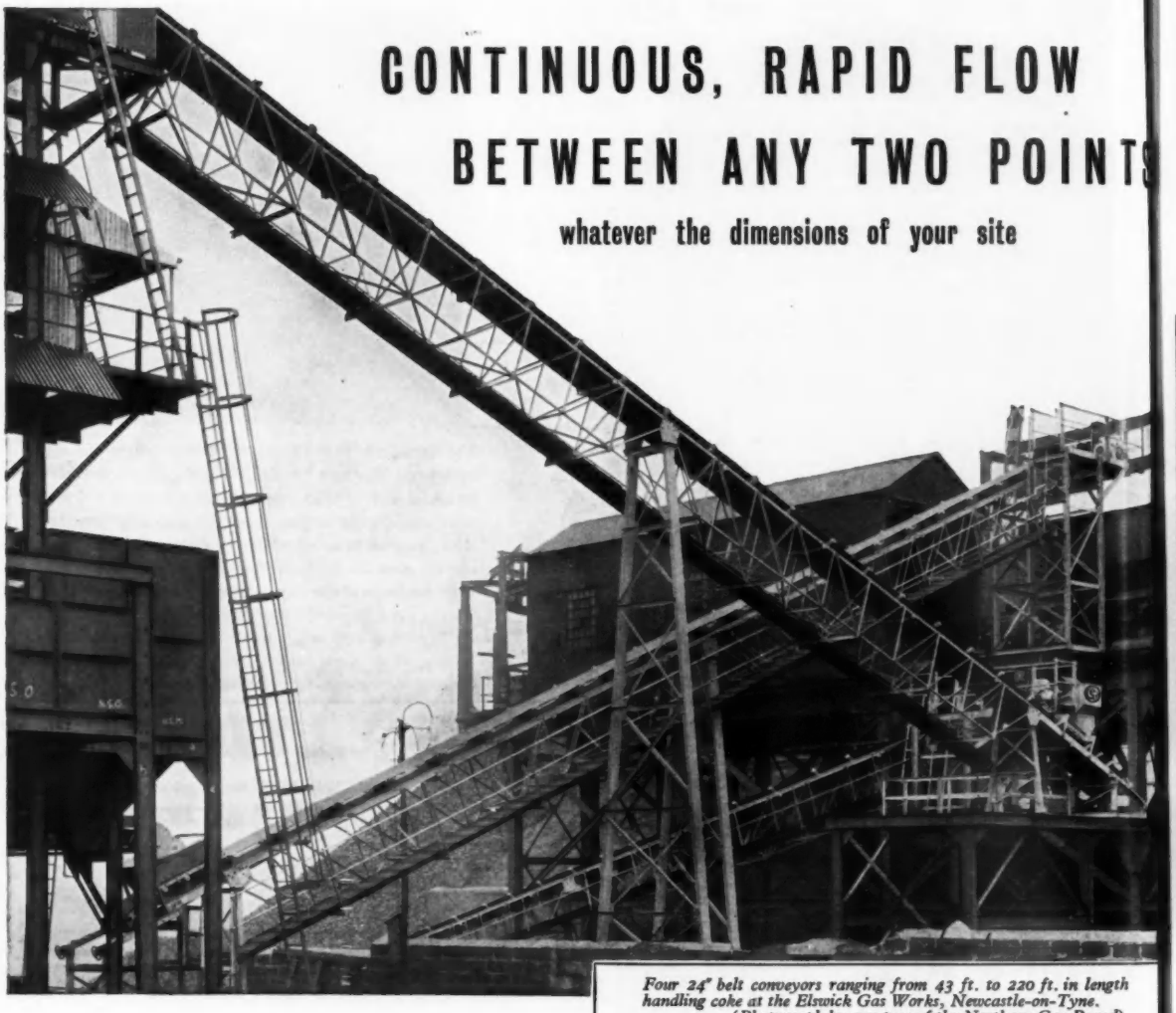
FWS

CONTINUOUS, RAPID FLOW BETWEEN ANY TWO POINTS

whatever the dimensions of your site



Four 24" belt conveyors ranging from 43 ft. to 220 ft. in length handling coke at the Elswick Gas Works, Newcastle-on-Tyne. (Photograph by courtesy of the Northern Gas Board).

Whatever type of raw material you handle, C & T "Standard Unit" Conveyors provide continuous, rapid flow from point of reception to point of delivery whatever the size or shape of your site. Because the conveyors are built in standard units, they can be supplied in any form to meet your individual requirements and reasonably prompt delivery can be assured.

Manufactured by Crone & Taylor Ltd., makers of the famous "Big Walrus" and other stacking and loading equipment, C & T "Standard Unit" Conveyors are renowned for their sound, rigid construction and easy accessibility. Further information about these and other aspects of the C & T range will be gladly sent on request.

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SUTTON OAK, ST. HELENS, LANCASHIRE
CABLES: CRONTAYLOR

I.C.H.C.A.

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CT5875

120 TONS COAL PER HOUR STACKED 12 FT. HIGH with a BIG WALRUS

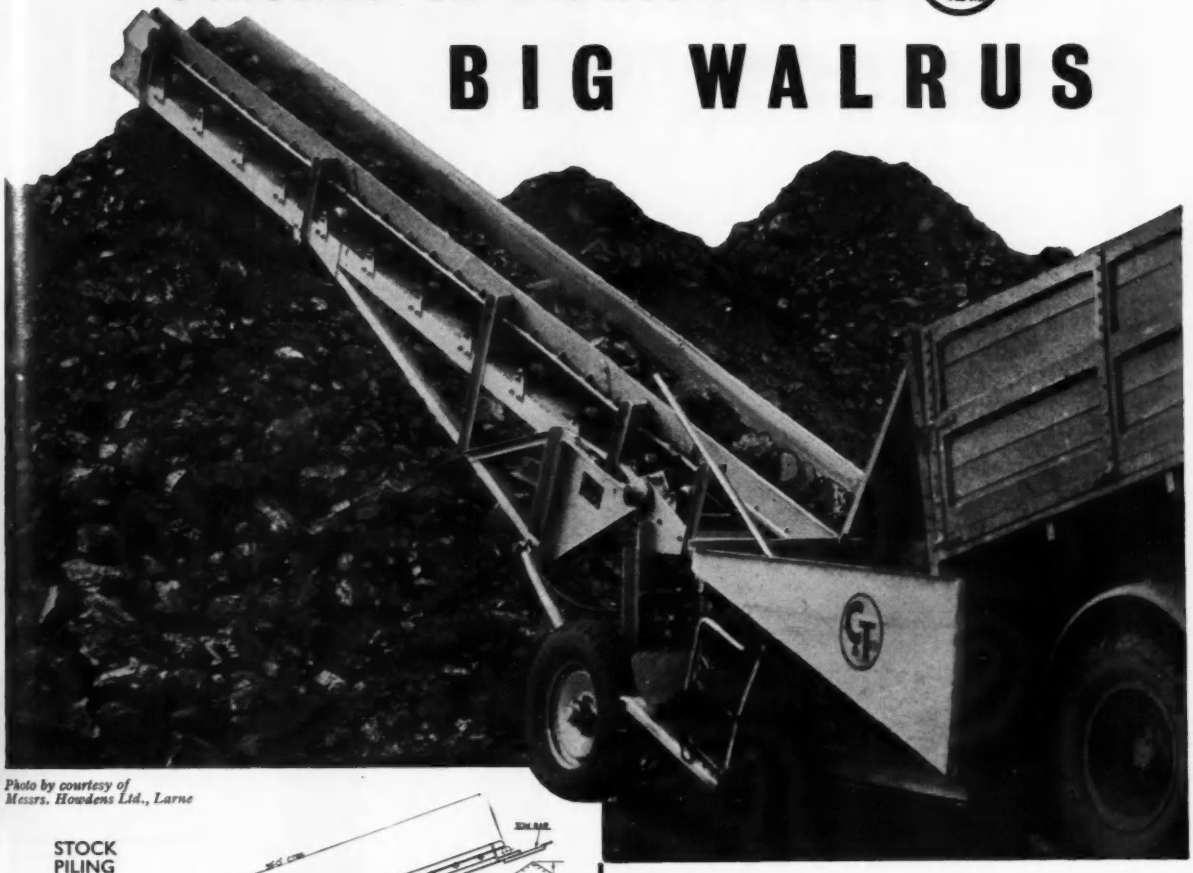
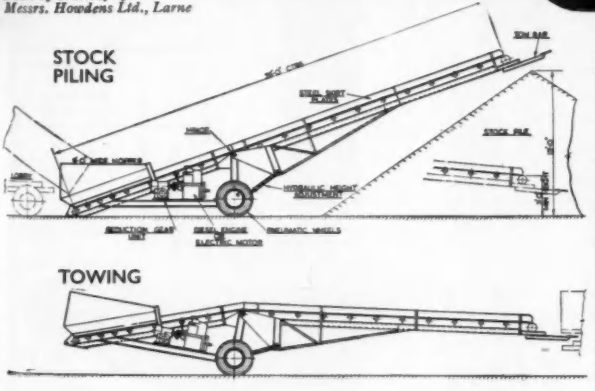


Photo by courtesy of Messrs. Howdens Ltd., Larne



Our range includes; mobile or static conveyors, package stackers, mobile screens, etc.

A brilliant new addition to our famous range of stackers. The "BIG WALRUS" is fully mobile on pneumatic tyres and completely roadworthy having brakes and built in tow bar. The feed hopper is fitted with elevating gear to give a road clearance of 12 ins.

The "BIG WALRUS" gives trouble-free service — stacking to an effective height of 12 ft. Delivery angle can be adjusted from 3 ft. to 13 ft. 3 ins. by either hand or power operated hydraulic gear.

Normal capacity 120 tons coal or 250 tons chrome ore per hour—can be increased if desired.

Powered by Electric or Diesel.

Early delivery. Full details gladly sent.

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PATENT AUTOMATIC COKE WEIGHER

Approved by the Board of Trade and stamped by the Weights and Measures Authorities.

Capacity : 28 to 112 lbs. per discharge (nett).

Speed of Weighing : Up to six weighings per minute.

Guaranteed accuracy and continuity of operation.

Machines may be seen working by appointment.

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RICHARD SIMON & SONS, LTD.
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BASFORD, NOTTINGHAM

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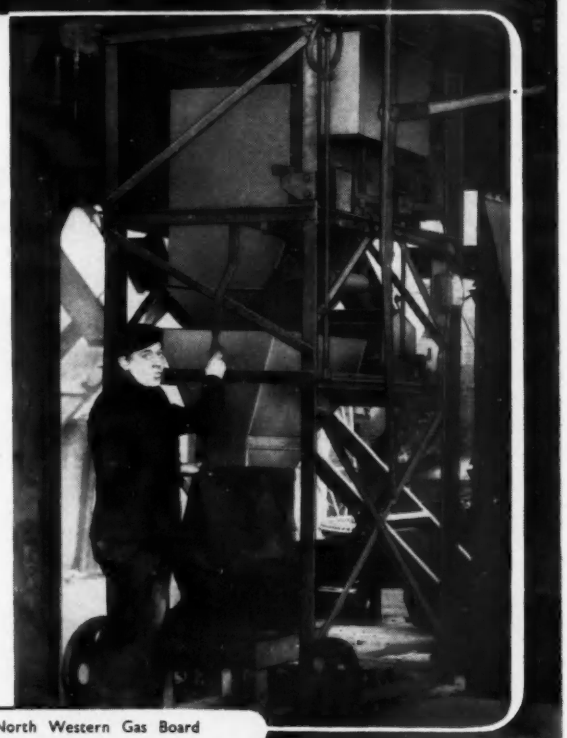

By Courtesy of the North Western Gas Board

THORP EQUIPMENT FOR THE GAS INDUSTRY

GAS FLOW INDICATORS

Direct Reading, variable aperture type, from 0 to 150 lb./sq. inch.

For all types of gases; can be calibrated to customers' requirements. Brass body, stoved black crinkle finish.

Cast Iron Body for Corrosive Gases.

Scale Plate in black crinkle, chrome or polished brass.

All Unions, etc., chrome plated.

Stainless Steel Float, in clear glass tube.

Customers when ordering should state—
(*a*) Specific Gravity and Working Pressure.
(*b*) Maximum and Minimum Rates of Flow.

Size B.S.P. ins.	Max. Capacity Cu. ft./Hr. Coal Gas @ 5/10" P.D.
¼	25
⅜	60
½	110
¾	230
1	420
1¼	650
1½	900
2	1600
2½	2500

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THE PEART (PATENT)
LEADLESS SPLIT COLLAR

PATENT NO. 733220

★ PATENT MOULDED RUBBER JOINTS, RUBBER CONFORMING TO B.S.S. 772.

★ GUARANTEED SEAL WITHOUT USING LEAD

★ EASILY TRANSPORTED.

★ ONE SPANNER ONLY REQUIRED.

★ CAN BE FITTED IN TEN MINUTES.

★ CAN BE SUPPLIED WITH OR WITHOUT BOSS.

★ DRILLED AND TAPPED ¼"-2" B.S.P. IF REQUIRED.

★ TESTED UP TO 350 lbs. p.s.i. HYDRAULIC PRESSURE.

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Associated with Stokes Castings Ltd.

The Smaller Company can generally

1. **QUOTE** a lower price because, whilst the cost of materials and wages is practically the same for all, its overhead charges are unquestionably under closer control.
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We submit these important points for the consideration of Engineers sending out their enquiries for Gas Works Ancillary Plant.

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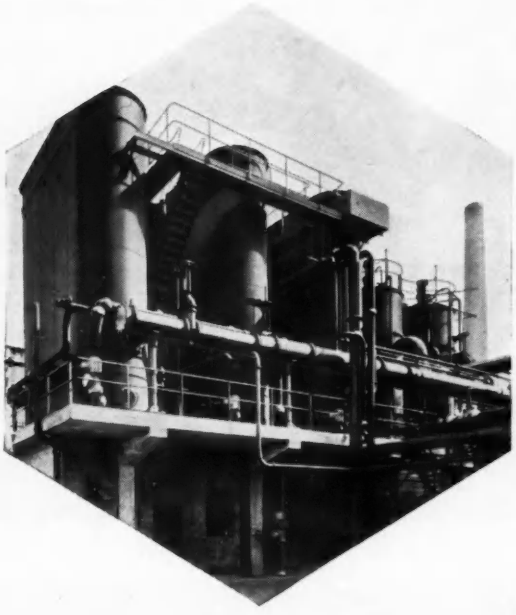
WHESSOE -- at FISHBURN



WHESSOE fabricated and erected to the order of the WOODALL-DUCKHAM Company, the following plant for the N.C.B. Carbonisation Plant at Fishburn.

Primary Coolers: Three mild steel welded vertical tube multi-pass primary condensers operating in parallel, fabricated to W-D designs.

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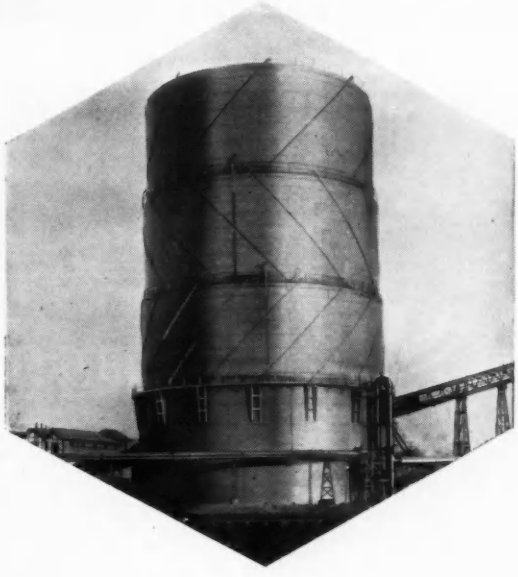
Gasholder: One 500,000 cu. ft. capacity 3 lift spiral-guided welded gasholder. This holder was designed to throw approximately 17" W.G. total pressure, with the inner lift throwing 9" W.G., to provide adequate pressure at the coke ovens.

A notable feature of the welded construction was the 5% radiographic check on the welding in the tank. This was carried out by one of the Whessoe Mobile Radiographic Units.



WHESSOE FOR GAS TREATMENT AND STORAGE

An advertisement of Whessoe Ltd., Darlington, England. Telephone: Darlington 5315 • London Office: 25 Victoria Street, London, S.W.1. Telephone: Abbey 3881

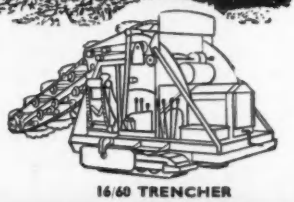
W61

12/21 MODEL FOR NARROW TRENCHES

The answer to all your trenching problems

ALLEN *Super Duty* TRENCHERS

For narrow trenches we supply the 12/21 model, and for wide trenches the 16/60 model. Both models are a fine engineering job and capable of standing up to continuous hard work. We shall be pleased to send you further information and fully illustrated brochures on request.



16/60 TRENCHER

JOHN ALLEN & SONS (OXFORD) LTD. COWLEY OXFORD *Tel 77155/6/7*

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THE SYMBOL OF SERVICE AND QUALITY

VITREOUS ENAMELS
VITREOUS ENAMELLING
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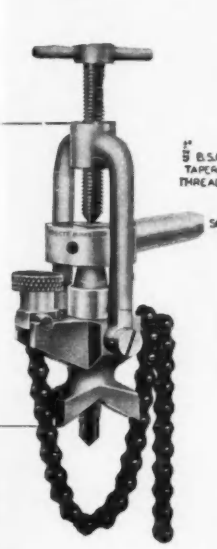
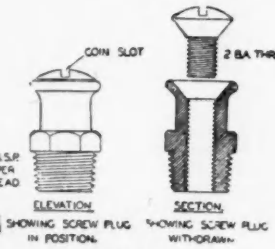
A RANGE OF "ABBIRKO" SPECIALITIES FOR PROMPT DELIVERY





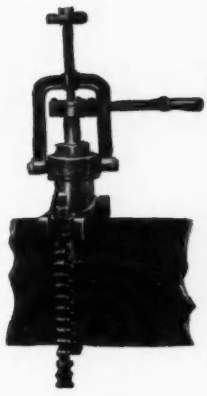
"ABBIRKO" MINIATURE RATCHET DRILLING AND TAPPING MACHINE

DRILLS AND TAPS, ¼" to 4" W.I. TUBES

For inserting Pressure Testing Nipples (as illustration) or taking off *Branches* ¼" to ¾" *B.S.P.* Saves expensive cutting out and insertion of Tees

SHORT'S SURFACE GAS LEAK INDICATOR

Fig. A3



Loose "Cup" Patt. Drill Tap

Solid Patt. Drill Tap

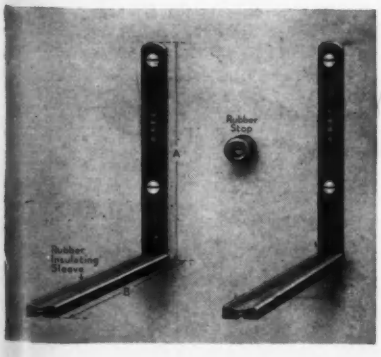
"ABBIRKO" CENTRAL ACTION DRILL STANDS AND EQUIPMENT

No. 3 size ½" to 2" for accurately Drilling and Tapping Gas and Water Mains

GL 84 GAS METER BRACKETS

Showing Rubber Sleeves and Stop in position

Electrically Insulated : supplied in five sizes



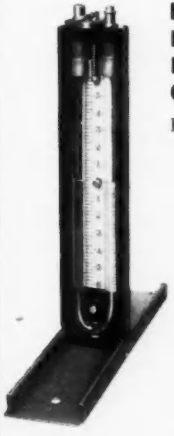


Fig. 199

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Fig. 40

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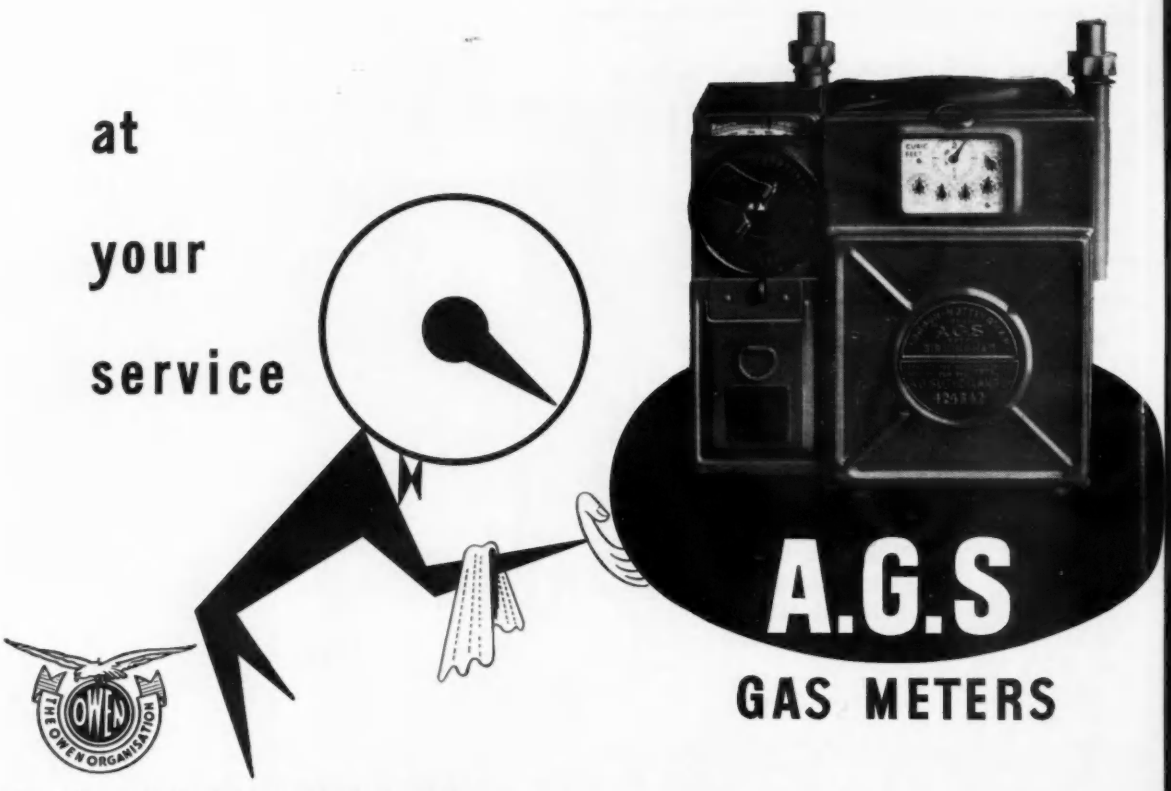

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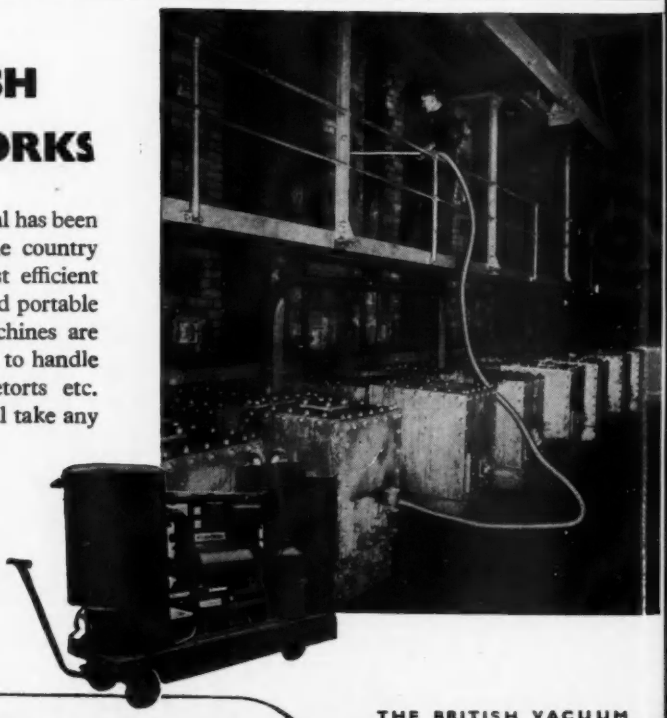

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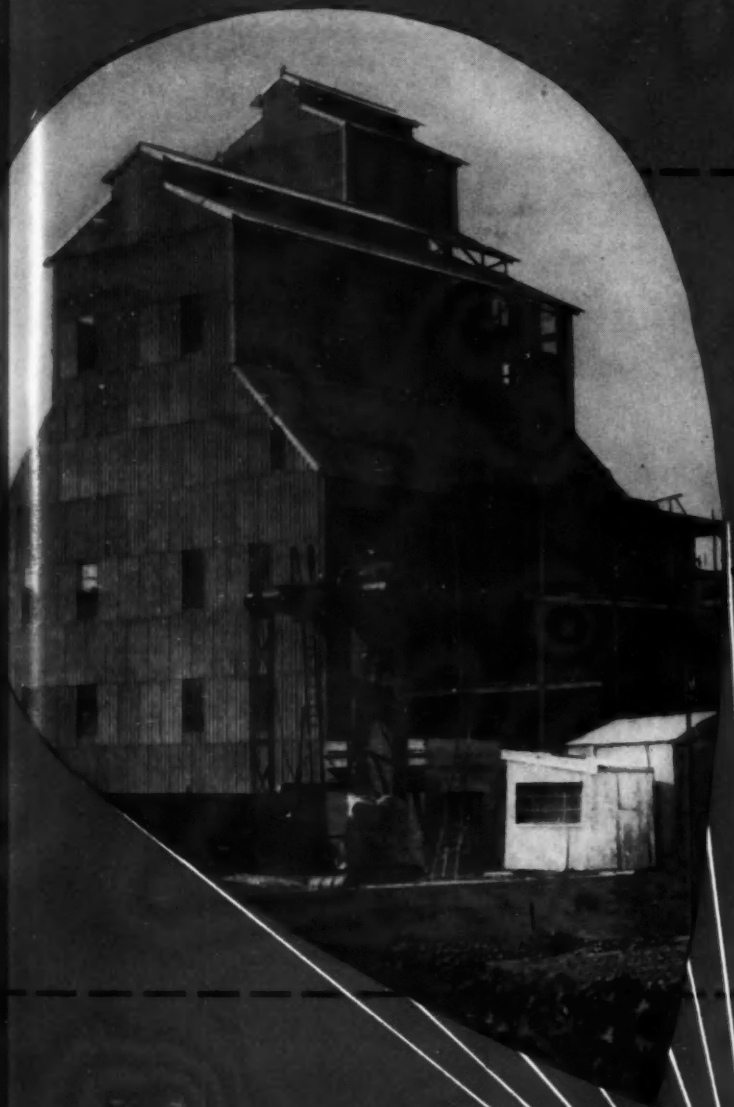

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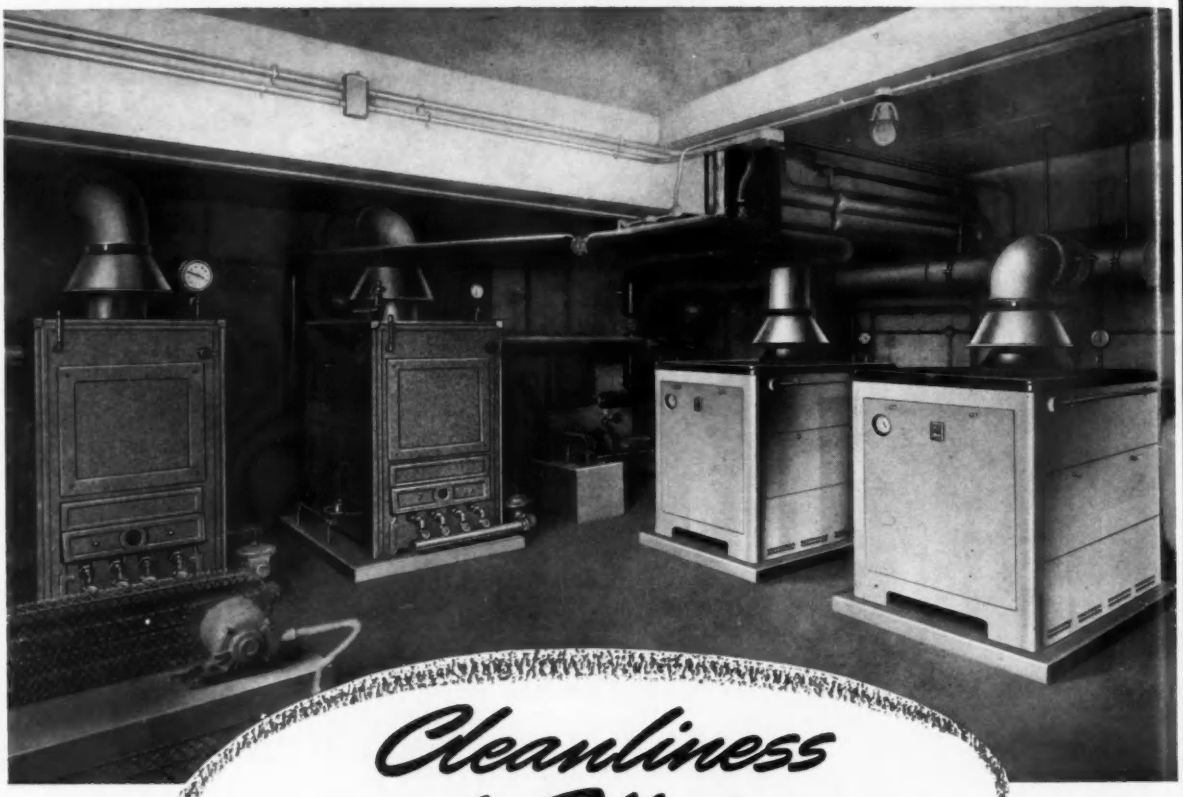

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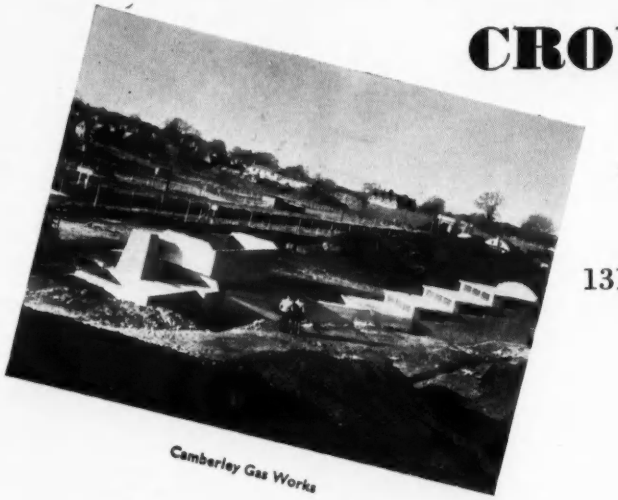
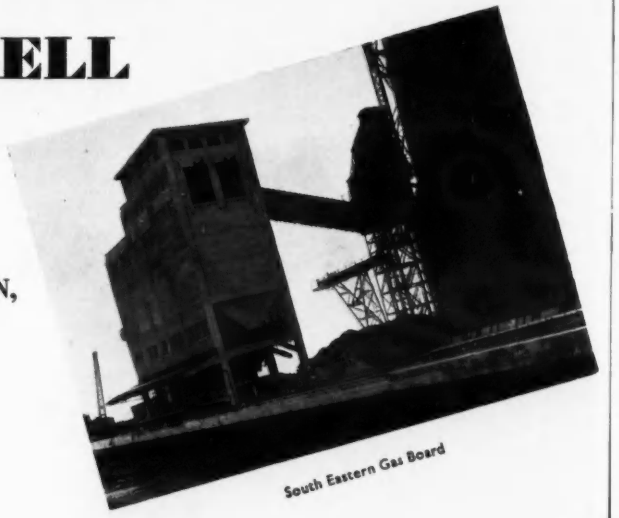


Camberley Gas Works



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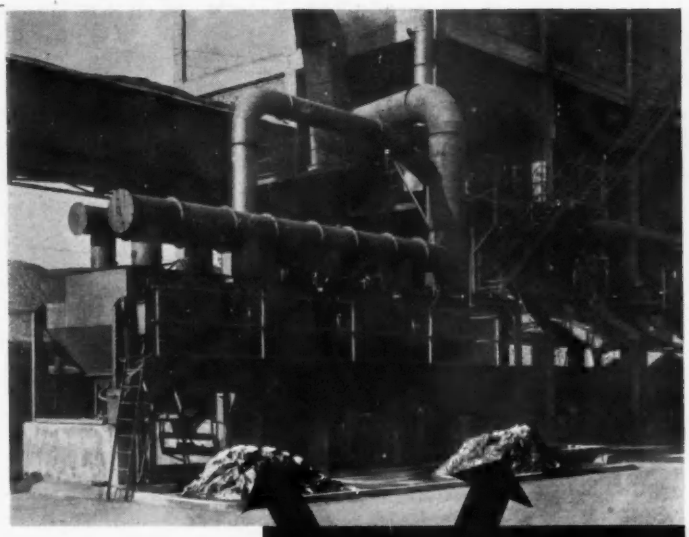

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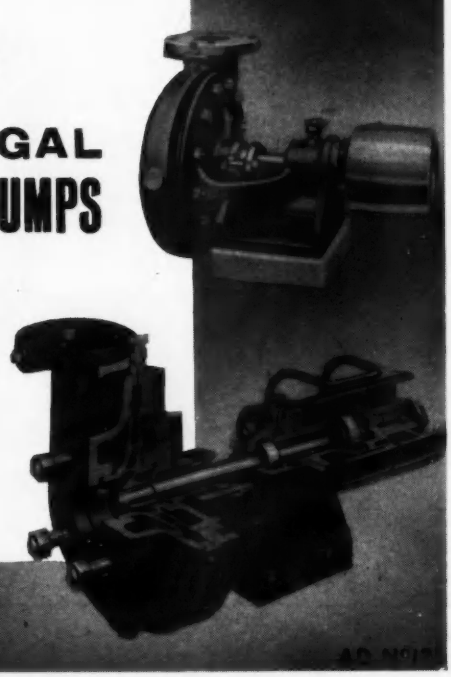

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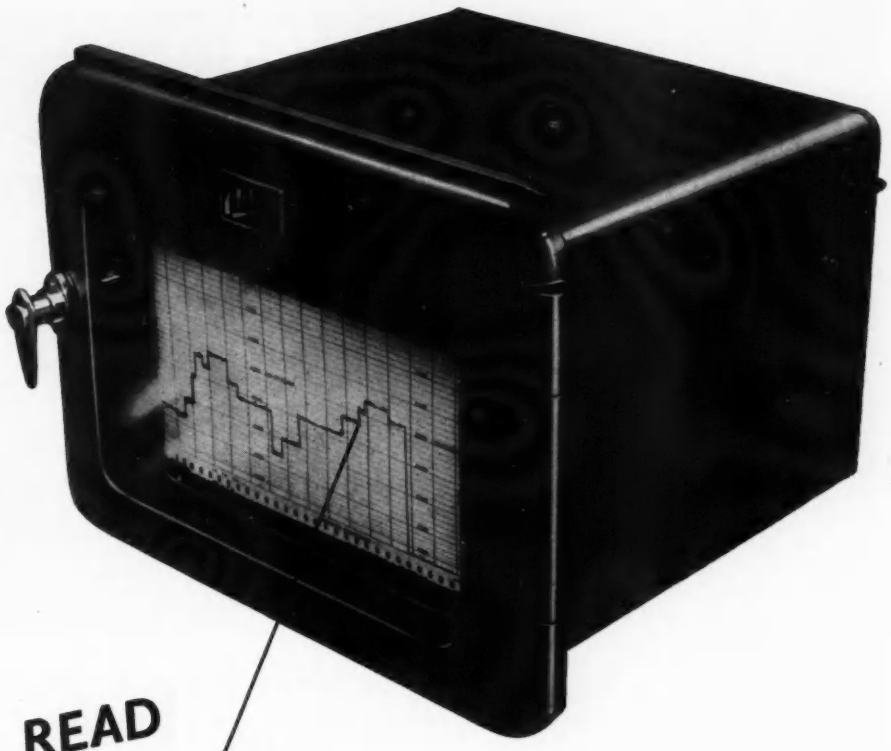

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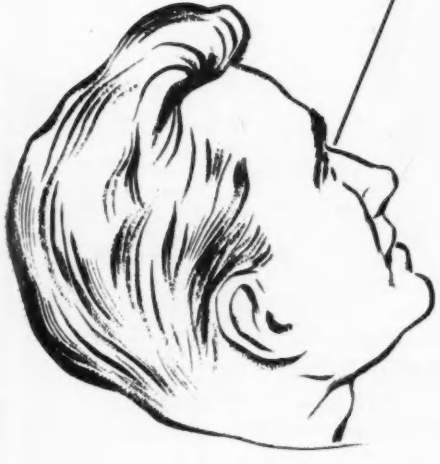

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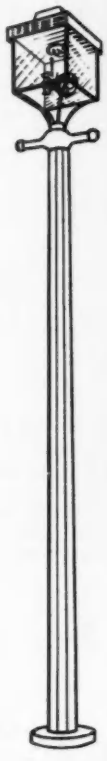

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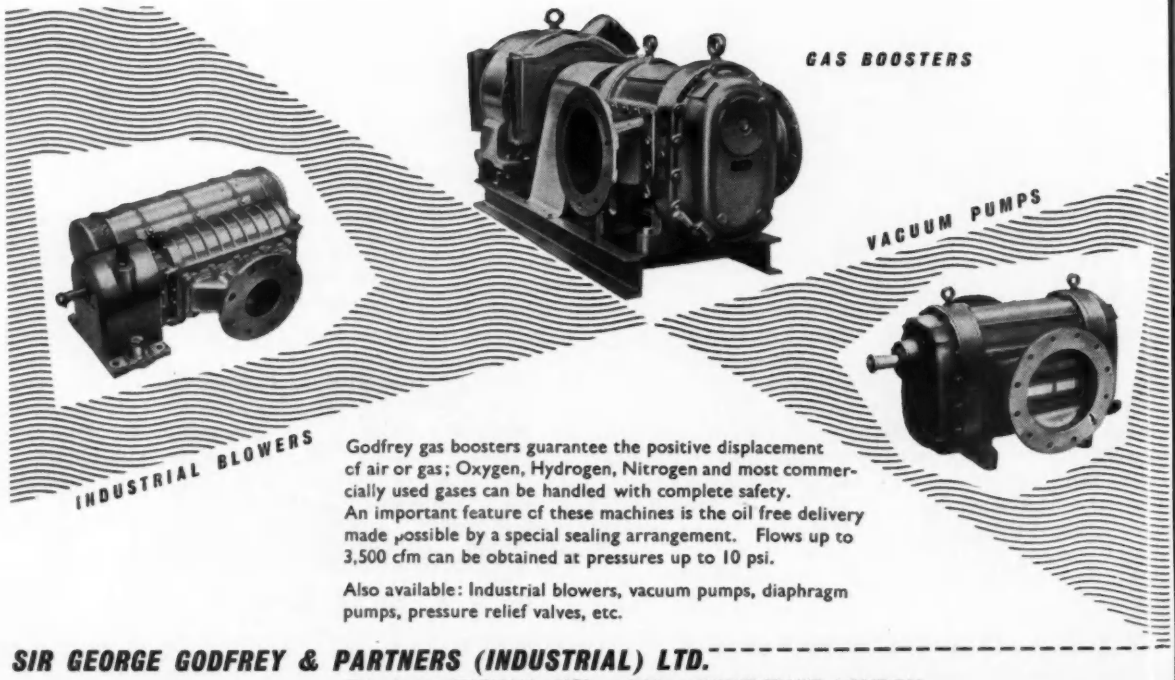

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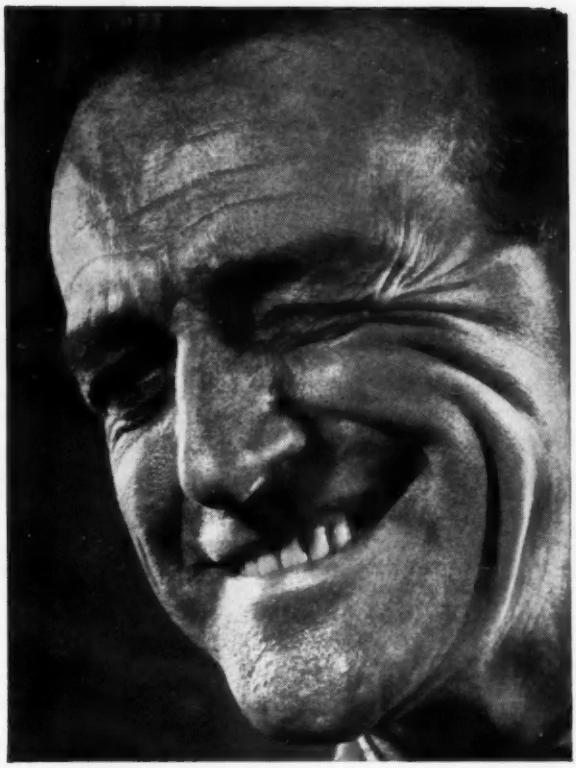

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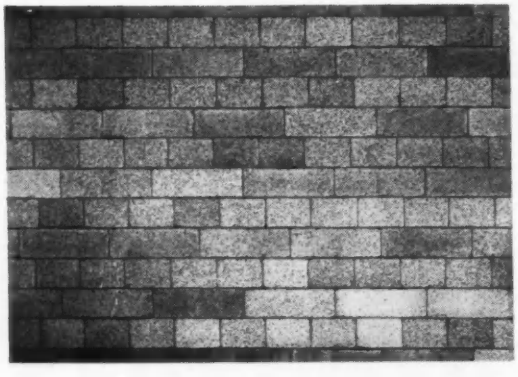

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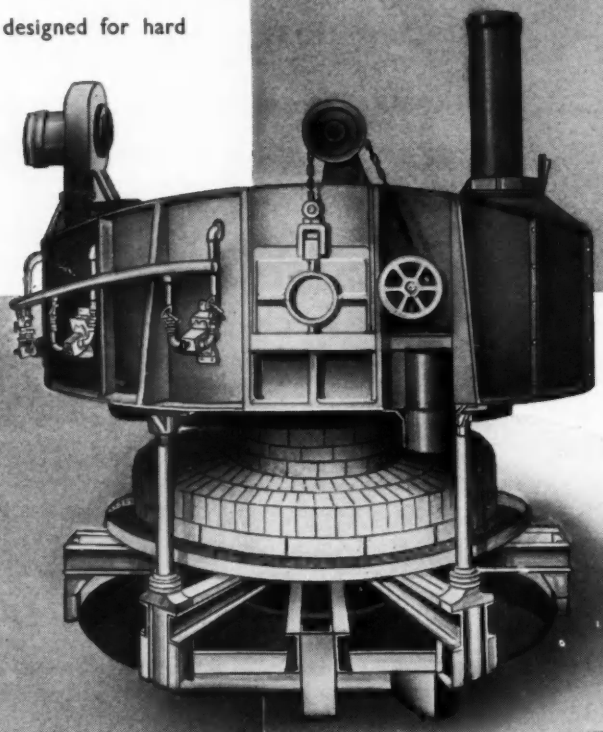

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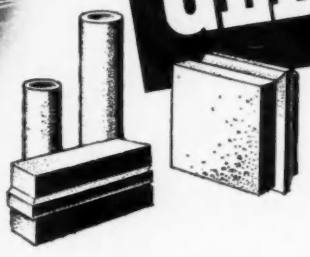

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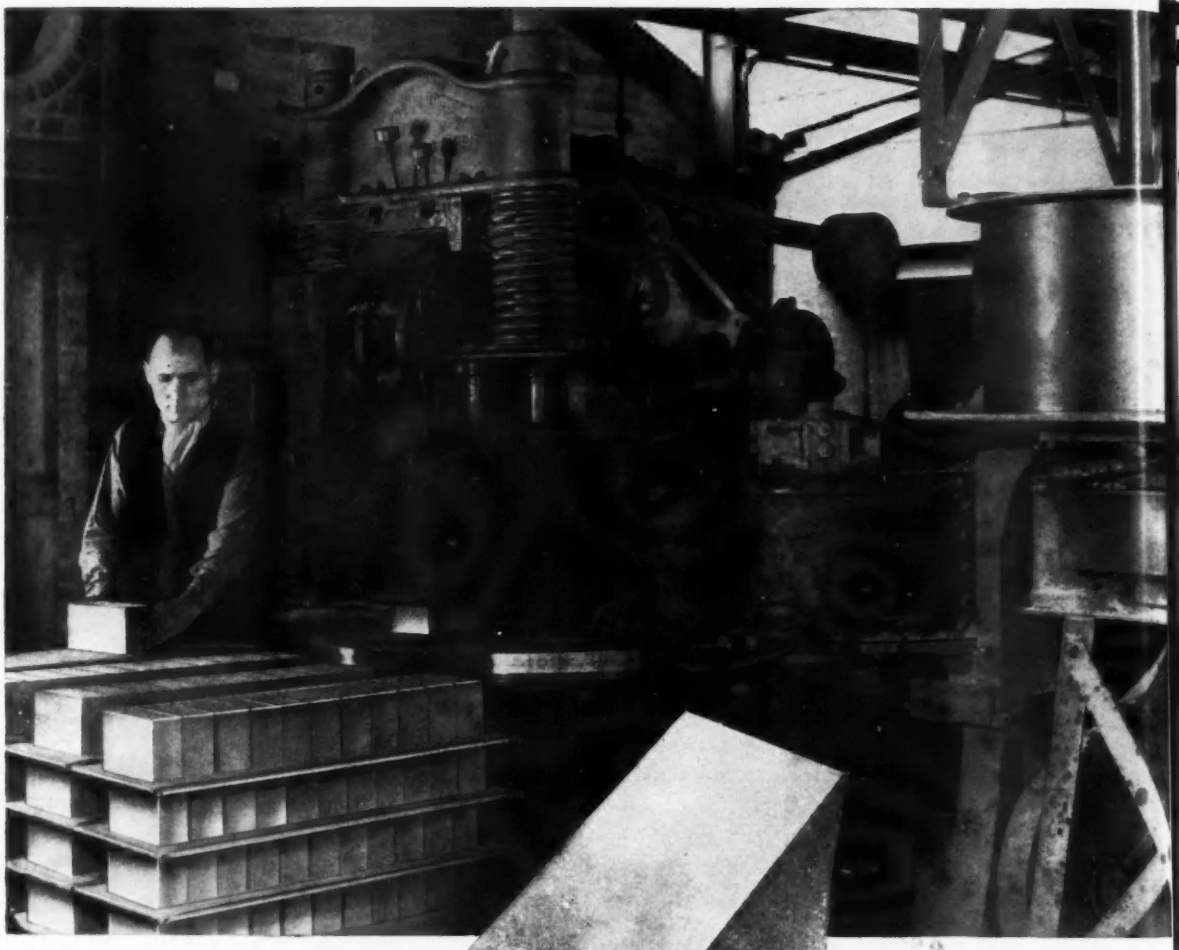

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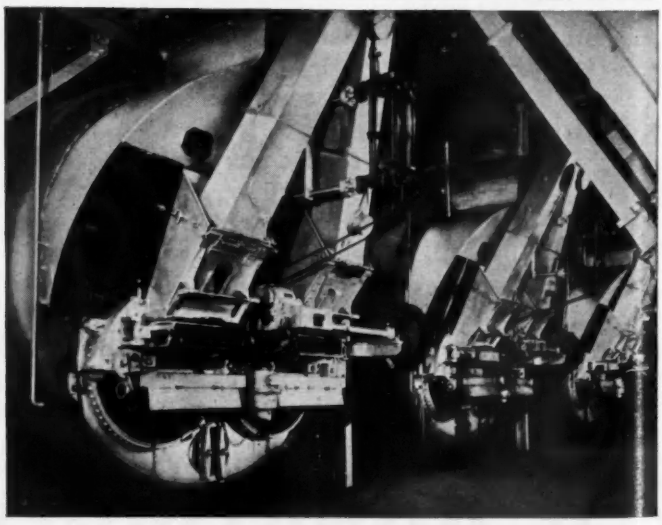

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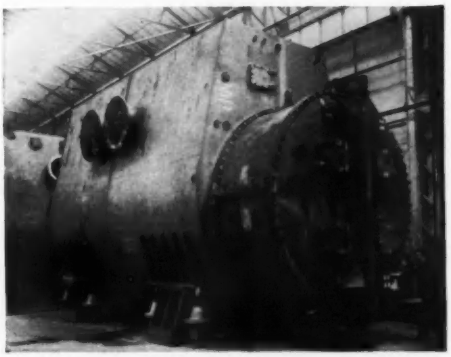

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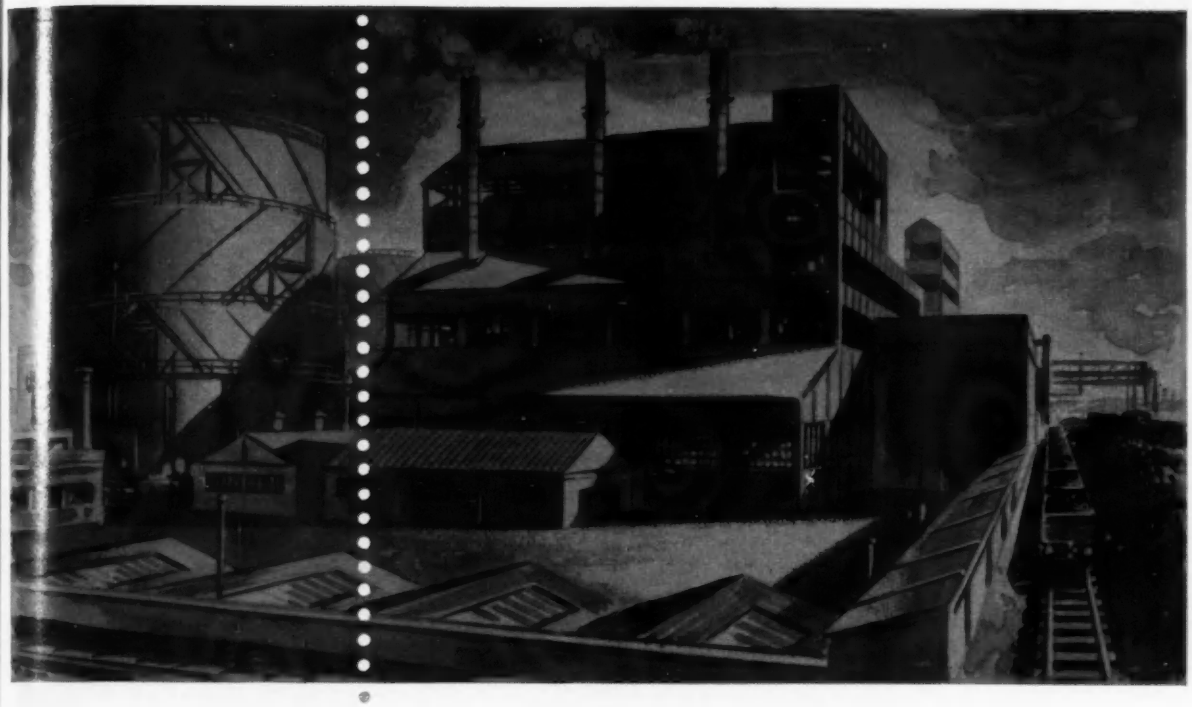

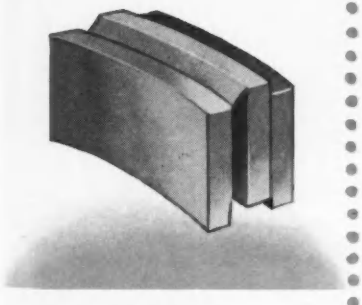

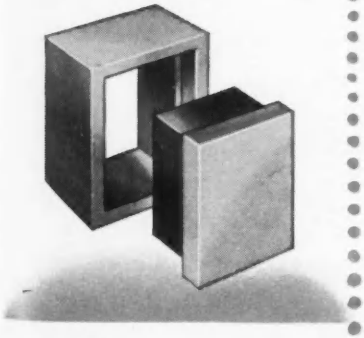

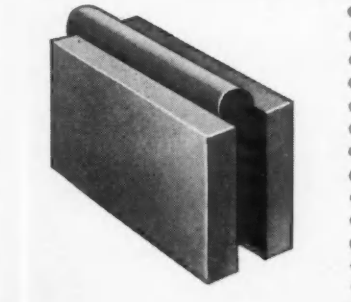

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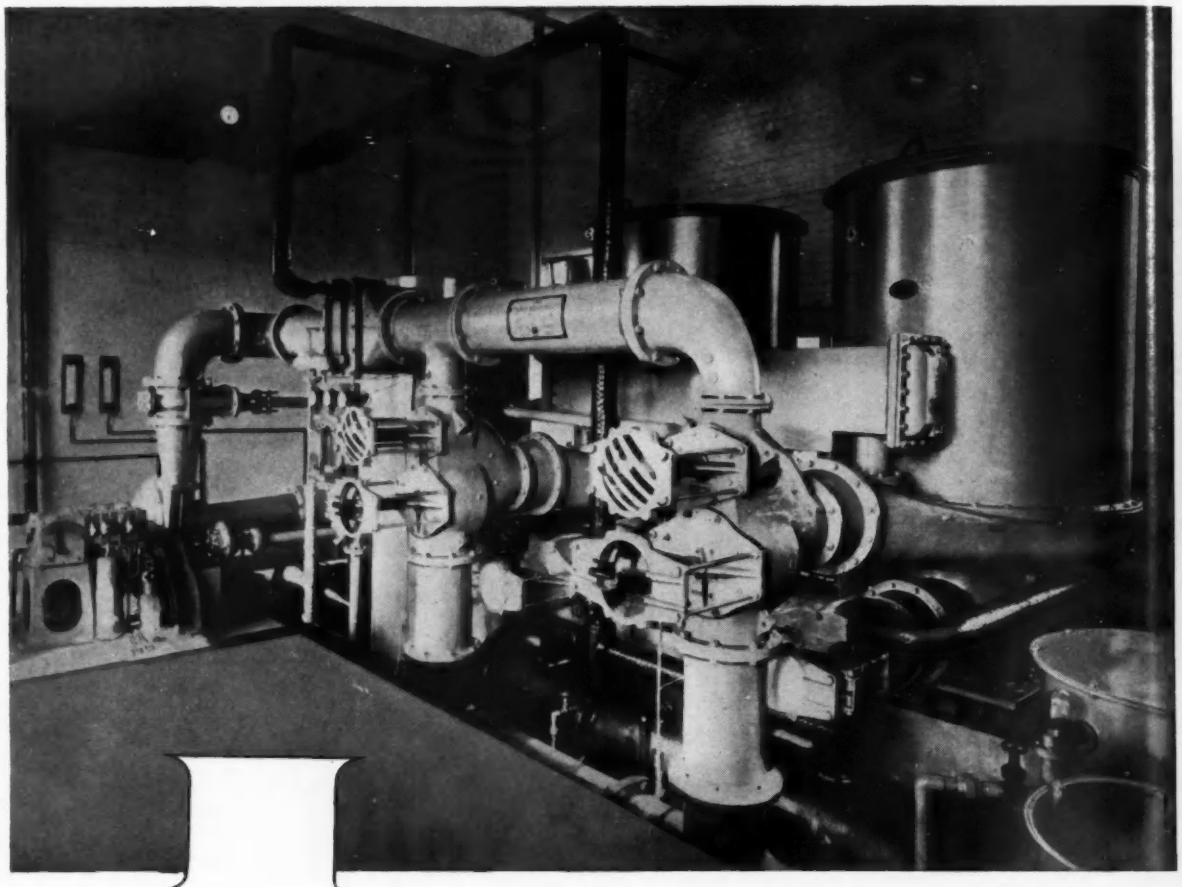

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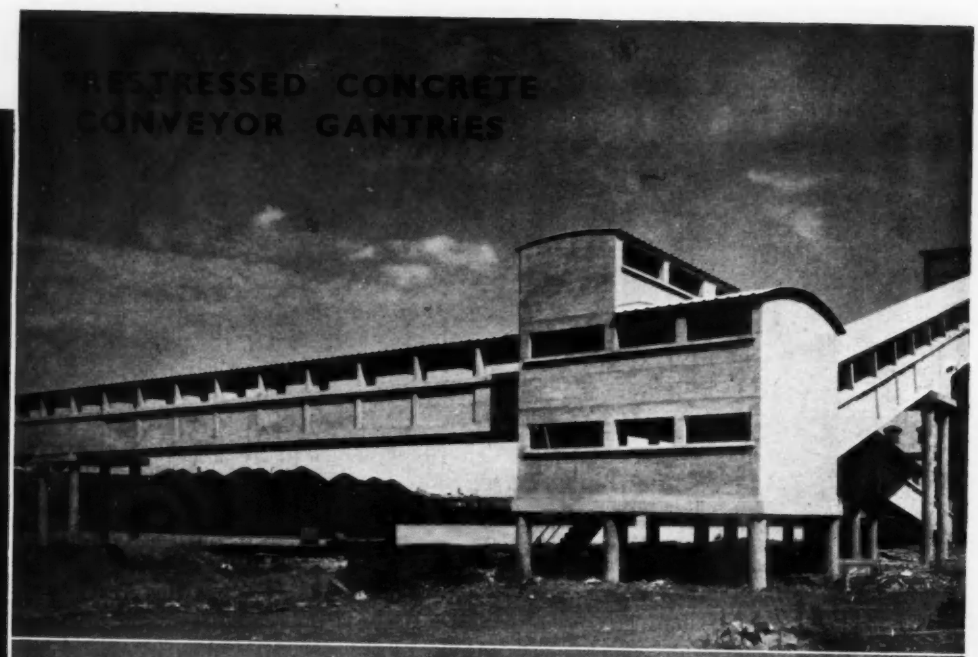

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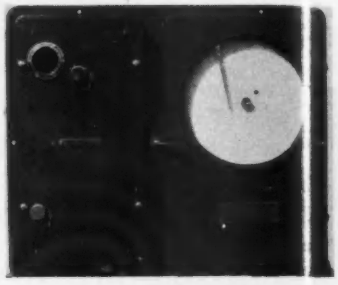

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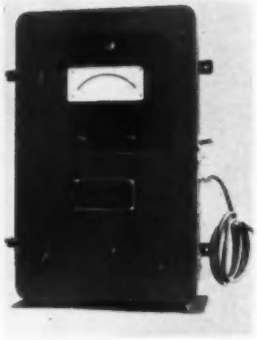

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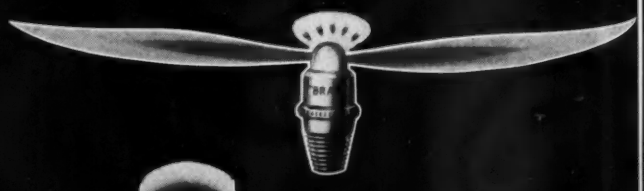

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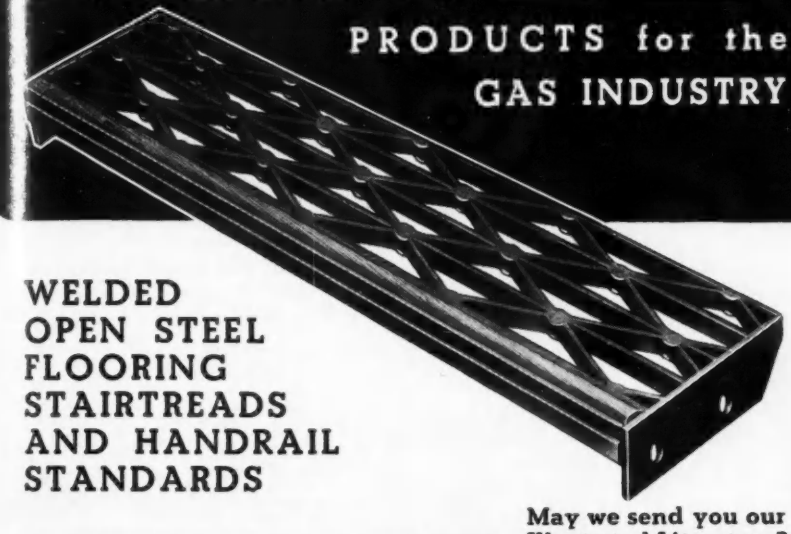

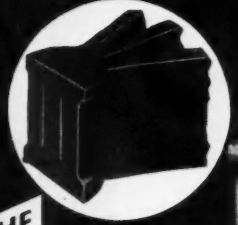

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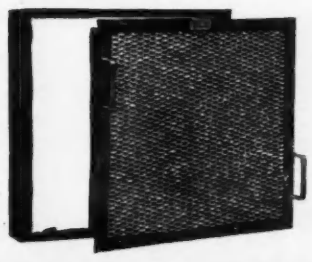

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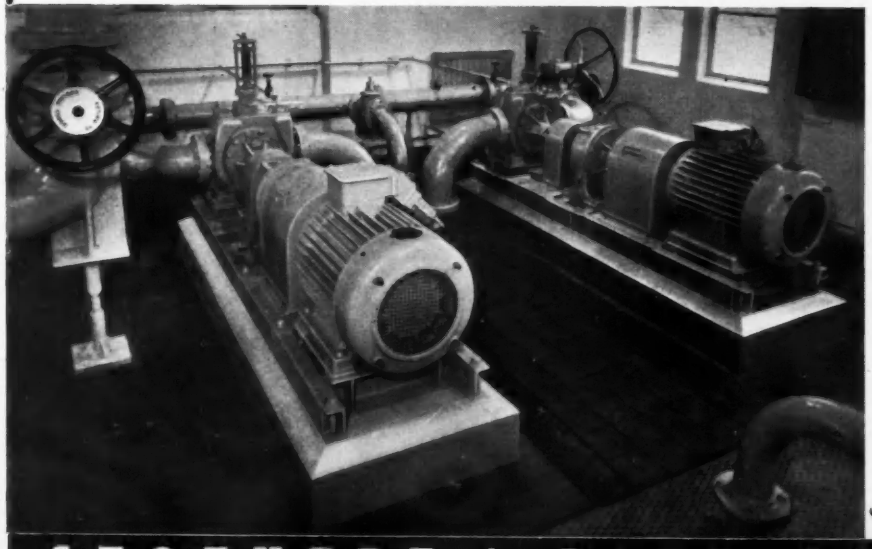

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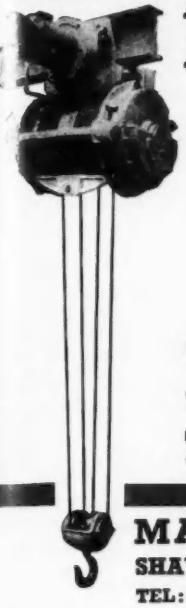

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INDEX TO 'JOURNAL' ADVERTISERS

	Page
A	
A.C.E. Machinery, Ltd.	663
Abbot Birks & Co., Ltd. ...	...631, 643
Alder Mackay, Ltd.	612
Aldrich & Ranken, Ltd.	631
Allan Taylor (Engineers), Ltd. ...	635
Allen, John, & Sons (Oxford), Ltd....	642
Ashmore, Benson, Pease & Co. ...	664
Associated Lead Manufacturers, Ltd.	630
Astral Products.	662
Automatic Telephone & Electric Co., Ltd.	632
B	
Bayley, Thos. (Great Bridge), Ltd. ...	742
Begwaco Meters, Ltd.	694
Blakeley, Firth, Sons & Co., Ltd. ...	608
Bray, George, & Co., Ltd.	668
British Carbo-Norit Union, Ltd. ...	674
British Thermostat Co., Ltd. ...	619
British Vacuum Cleaner & Engineering Co., Ltd.	644
Brown, J., & Co., Ltd.	742
C	
Cambridge Instrument Co., Ltd. ...	737
Cannon (G. A.), Ltd.	734
Cathodic Corrosion Control, Ltd. ...	648
Clayton, Son & Co., Ltd.	614
Clifford Engineering Co., Ltd. ...	742
Cockey, Edward, & Sons, Ltd. ...	624
Consolidated Pneumatic Tool Co., Ltd.	631
Controlled Flame Boilers, Ltd. ...	661
Croager Bros. (Homerton), Ltd. ...	657
Crone & Taylor, Ltd. ...	...636, 637
Crosby & Co., Ltd.	...cover II
Crowley, Russell, & Co., Ltd. ...	647
Cutler S. & Sons Ltd., ...	737
D	
D. & C. & Wm. Press, Ltd.	713
Davey, Paxman & Co., Ltd. ...	660
Dempster, R. & J., Ltd.	605
Dempster, Robert, & Sons, Ltd. ...	738
Diaphragm & General Leather Co., Ltd.	650
Donkin (The Bryan) Co., Ltd. cover II,	692
Drakes, Ltd.	606
Drummond Patents, Ltd.	649
E	
Electric Construction Co., Ltd. ...	626
Electroflo Meters Co., Ltd.	616
Erskine, Heap & Co., Ltd.	621
Essex Partners, Ltd.	674
F	
F. C. Construction, Ltd.	659
Fielden Electronics, Ltd.	662
Film Cooling Towers (1925), Ltd. ...	650
Flavell, S., & Co., Ltd.	716
G	
Glenboig Union Fireclay Co., Ltd....	657
Gibbons (Dudley), Ltd.	658
Glover, Thomas, & Co., Ltd.	...676, 706
Goodall, Clayton, & Co., Ltd. ...	654
Godfrey, Sir George & Partners (Industrial), Ltd.	652
Graphite Products, Ltd.	742
Gunite Construction Co., Ltd. ...	671
H	
Holmes, W. C., & Co., Ltd....	704, 705, 741
Hopkinsons, Ltd.	633
Horstmann Gear Co., Ltd.	652
Humphreys & Glasgow, Ltd. ...	726
I	
I.C.I., Ltd. (Metals Division) ...	634
Ideal Boilers & Radiators, Ltd. ...	646
Infra Red Development Co., Ltd. ...	668
J	
Jeavons, E. E., & Co. Ltd.	672
Jenkins, W. J., & Co., Ltd.	645
K	
Keith Blackman, Ltd.	742
King, Walter, Ltd.	655
Kirkham, Hulett & Chandler, Ltd....	640
L	
La Farge Aluminous Cement Co., Ltd.	609
Leeds Fireclay Co., Ltd.	665
Lind, Peter, Ltd.	667
Lionweld, Ltd.	669
M	
Magnetic Valve Co., Ltd.	613
Matterson, Ltd.	671
Meltham Silica Fire Brick Co., Ltd....	611
Meters, Ltd.	723
Midland Iron & Hardware Co. (Cradley Heath), Ltd.	654
Mitchell, H., & Co.	662
Murex Welding Processes, Ltd. ...	653
N	
National Benzole Co., Ltd.	730
National Cash Register Co., Ltd. ...	653
National Enamels, Ltd.	648
Newton Chambers & Co., Ltd. cover I	
O	
Oxley Engineering Co., Ltd. ...	729
P	
Parkinson & Cowan(Gas Meters), Ltd.	676
Pass, E., & Co., Ltd.	670
Peart, E., & Co., Ltd....	639
Plenty & Son, Ltd.	674
Power Gas Corporation, Ltd. ...	664
Press, William, & Sons, Ltd.... ...	615
R	
Radiant Heating, Ltd....	607
Radiation, Ltd.	...714, 715
Reavell & Co., Ltd.	742
Ride & Bell, Ltd.	623
Robinson, J. H., & Co. (L'pool), Ltd.	617
Royston, G., & Son, Ltd.	733
Rozalex, Ltd.	654
Ruscoe, John, & Co., Ltd.	660
S	
Salter, T. E., Ltd.	675
Sankey-Sheldon, Ltd....	625
Scientific & Projections, Ltd. ...	620
Shandon Scientific Co., Ltd.... ...	671
Sigma Instrument Co., Ltd. ...	635
Simon, Richard, & Sons, Ltd. ...	638
Smith Meters, Ltd.	703
Sperryn & Co., Ltd.	633
Stanton Ironworks Co., Ltd....	cover IV
Staveley Iron & Chemical Co., Ltd....	628
Stein, John G., & Co., Ltd.	654
Stewart & Gray, Ltd....	642
Stewarts & Lloyds, Ltd.	693
Stothert & Pitt, Ltd.	670
Stoves, Ltd.	629
Sutcliffe Speakman & Co., Ltd. ...	666
Sutherland, A. G., Ltd.	644
T	
Tangyes, Ltd.	649
Thermic Equipment & Engineering Co., Ltd.	656
Thorp, Thos., & Co., Ltd.	638
U	
Underpressure Engineering Co., Ltd.	742
V	
Visco Engineering Co., Ltd.... ...	669
W	
Walter King, Ltd.	655
Walker, Crosweller & Co., Ltd. ...	651
Waller, George, & Son, Ltd. ...	618
West's Gas Improvement Co., Ltd....	724, 725
Westwood & Wrights, Ltd.	610
Whessoe, Ltd.	641
Whittaker Ellis, Ltd.	622
Willey & Co., Ltd.	cover III
Wilson, George (Gas Meters), Ltd....	627
Woodall-Duckham Construction Co., Ltd.	691

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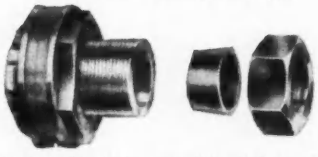

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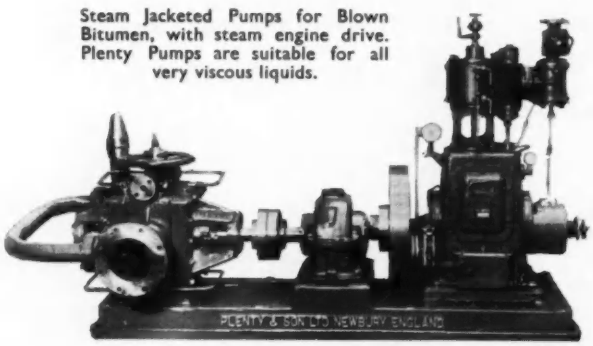

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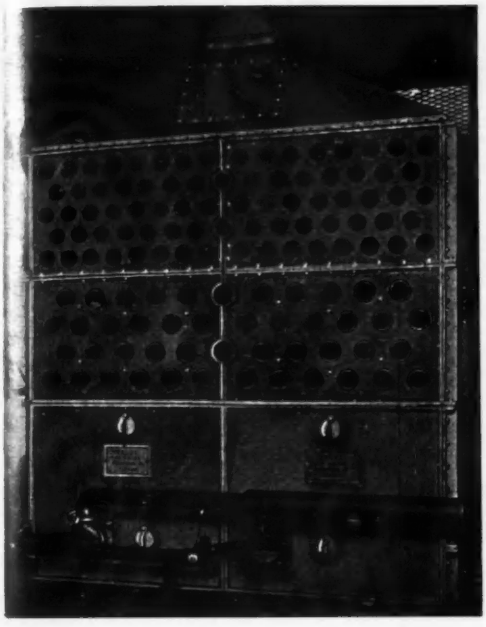

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Gas Journal

VOL. 282 NO. 4801 June 8, 1955

107TH YEAR

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CONTENTS

EDITORIAL COMMENT

Efficiency and Economy .. 677
Gas for Launderettes .. 678
Chemical Plant .. 678

INSTITUTION OF GAS ENGINEERS— 92nd ANNUAL MEETING

Three New Honorary Members .. 679
New President and Vice-Presidents .. 680
Institution Medallists .. 680
General Review of the Meeting .. 681
The Benevolent Fund .. 686
Accelerated Continuous Carbonization. By W. Hodkinson, T. Nicklin, and M. Redman, North Western Gas Board 687
The 'Backbone' Main in the East Midlands Area. By E. W. Pickering and J. B. Walsh, East Midlands Gas Board .. 689
Pumping of Liquids on Gasworks. By L. J. Clark, North Thames Gas Board .. 695
Town Gas and the Changing Needs of Industry. By R. F. Hayman, Industrial Gas Officer, Gas Council, and E. A. K. Patrick, Watson House .. 697
Some Trends and Influences on the Domestic Load, By A. V. Horsfall, West Midlands Gas Board .. 699
The Architect and Industry. By E. D. Jefferiss Mathews .. 701
Fawley Refinery of the Esso Petroleum Co., Ltd. .. 707
Totton Tar Works of South Western Tar Distilleries .. 711
Southampton Gasworks .. 718
Hilsea (Portsmouth) Gasworks .. 722
Works Visits and Social Events .. 735
Many New and Exciting Developments; Institution's New President Foresees Great Changes .. 739
Cruise and Visit to East Cowes Works .. 740

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Gas Journal

VOLUME 282. No. 4801. JUNE 8, 1955. 107th YEAR

Efficiency and Economy

PERHAPS it was inevitable that last year's annual meeting of the Institution of Gas Engineers should have as its theme the first five years of nationalisation, their achievements and disappointments, and their promises for the future. This year's meeting, the 92nd, held at Southsea from May 24 to 27, did not mark the end of any special period nor was it the anniversary of any particular event. Consequently it could not achieve that certain novelty that attaches to extraordinary occasions. Nevertheless, the good attendance, the amount of work which was dealt with during the business sessions, and the interest shown in the visits and social events were such as to assure both the President and the Institution that the members found the meeting a source of education and mental refreshment.

Mr. William K. Tate, President, Institution of Gas Engineers.

If a theme might be detected in the addresses and papers presented to the meeting it would seem to have found expression in a general emphasis upon the most efficient and economical manufacture, distribution and utilization of gas. One had the impression that, after the broad reviews of the first five years of nationalisation which set the scene for the 91st annual meeting, this year's assembly was in a more self-critical mood, being interested particularly in producing gas more economically and selling more of it. The President, Mr. W. K. Tate, had a number of very trenchant remarks to make about the financial aspects of gas-making in his Presidential Address, and we shall refer to some of these later. In passing, however, we would pay a special tribute to Mr. Tate who, as most gas engineers will know, is leaving the Southern Gas Board to take up the post of Managing Director of Thomas Glover & Co., Ltd. We would only say this : the supply side's loss is the appliance manufacturers' gain.

One of the highlights of the Tuesday's business session was the presentation of a paper entitled 'Accelerated Continuous Carbonization' by W. Hodkinson, and his colleagues, T. Nicklin and M. Redman, of the North Western Gas Board. This paper was about further developments in the application of what is described variously as the 'Rochdale' process or the 'Carrier Gas' process, the title depending upon which part of the country one comes from. Mr. Hodkinson gave a very lucid explanation of the further work which has been done in connection with this process, and explained its advantages to his Board. It would seem quite clear that the coal/coke price ratio is a fundamental factor in the economics of the process, as is also the related declared calorific value of the gas supplied. Despite the fact that other boards (notably the North Thames Gas Board) have tried the process and found it of doubtful value, nevertheless, Mr. Hodkinson had no doubt that, in the North West, it has come to stay. In his view, its particular value lies in the fact that it enables a greatly increased output of gas to be obtained from existing carbonizing plants, thus avoiding the very heavy capital expenditure involved in putting down new plant with all that this implies.

In another sense, the importance of economical operation entered into the distribution paper which described the so-called 'Backbone' main of the East Midlands area. This paper was given by E. W. Pickering, Distribution Engineer of the Notts. and Derby Division, and J. B. Walsh, Distribution Engineer of the Leicester and Northants Division, and showed once again how the idea of integrating gas supplies within an area board has been seized upon and how, in this field, it has been possible to exploit measures for economical operation which had not existed prior to nationalisation. The 'Backbone' main is by no means unique but it does provide a further interesting indication of the way in which the gas industry is settling itself into the new pattern of fewer and larger manufacturing stations linked to each other and to other sources of supply by means of grid mains. In an era of rocketing costs, the industry can only hope to keep the price of gas reasonably stable by adopting such means as will enable it to concentrate its manufacture at the most efficient works. The grid system is obviously one of the most effective of these means.

Coming more and more to the forefront these days is the industrial utilization of gas, and it is in this sphere that our industry has made such remarkable advances in recent years. There can be little doubt that

this happy state of affairs is in large measure due to the enlightened and enthusiastic approach of the industrial gas engineer to his job, to his initiative in seeking out new uses for gas in industry and to his perseverance in pursuing any enquiry until it becomes an order. One of the gas industry's 'brightest hopes' is R. F. Hayman, Industrial Gas Officer to the Gas Council, and his paper to the meeting on 'Town Gas and the Changing Needs of Industry,' provided in a fascinating manner some facts about the problems of selling gas to industry. What is more important, it also showed how they are being tackled and solved. Mr. Hayman believes in taking the industrialist into his confidence from the start and in showing how gas can offer a better heat service for his particular purpose than any other competitive fuel. He laid great emphasis on this concept of a heat service, reiterating that what the industrialist requires is a *service* and that if the gas industry wishes to hold and expand this load, a *service* is what it must provide.

Since last year's annual meeting an event has occurred which coloured most of the speeches made at Southsea and which affected in some way or another many of the papers presented. This event, of course, was the submission of the Beaver Report last December and its acceptance in principle by the Government of the day. In earlier leading articles we have referred to this report and to its vital significance for the gas industry. During the annual meeting under review it was made clear that gas engineers as a whole are well aware of this significance and that, in consequence, they are regarding their industry as definitely committed to providing the two smokeless fuels of gas and coke.

To our way of thinking, a slightly recast quotation from Mr. Tate's Presidential Address sums up the feeling and the purpose of this year's annual meeting: 'Not to review the past, not altogether to prophesy the future, but rather as a vehicle by which to convey thoughts on the profession of gas engineering and its application to the gas industry'.

GAS FOR LAUNDERETTES

THE gas industry has an important part to play in the equipment of the modern launderette and small laundry and the unit dry cleaners' premises, and a welcome new addition to the Gas Council's literature is an 8 pp. brochure on the subject, giving advice on the selection and layout of equipment and showing how gas provides the first essential for the efficient operation of such establishments. It is emphasized that the equipment available for water heating for clothes washing and drying and for steam raising is reasonably low in capital costs and running costs, and that all appliances recommended by the gas industry have been submitted to stringent laboratory tests to ensure satisfactory and economical working. There is increasing provision of laundry services in hotels, hospitals, schools, and factories, and of communal laundries on housing estates, while the development of the launderette has been one of the notable changes in social habits in recent years. The primary need is for constant supplies of hot water, and gas heated boiler systems have great advantages in saving space, reducing labour, and ensuring cleanliness. Automatic thermostatic controls ensure efficient and economical working and flame failure devices eliminate all danger. Other gas appliances discussed include washing machines, drying cabinets, air heaters, tumblers, and ironing machines. The booklet is illustrated by photographs of typical installations, and it will be of particular value to architects and builders, local housing authorities, and those responsible for the provision of efficient services in hotels, hospitals, schools, and factories. Copies of *Gas for Launderettes, Small Laundries, and Unit Dry Cleaners* are obtainable on request from the Gas Council at Gas Industry House.

CHEMICAL PLANT

THE firm establishment in the United Kingdom of chemical engineering as the fourth primary technology is reflected in the growth of the British Chemical Plant Manufacturers' Association, whose recent annual report shows that in the past six years the Association has more than doubled in size. Last year saw the chemical plant industry working under conditions of freedom from controls which it had not enjoyed since 1939. Productive capacity was greatly increased and members of the B.C.P.M.A. were able to quote improved deliveries and to meet with confidence the demands which their customers, in particular the home chemical and allied industries, continued to make on them. Raw material supplies were still not as satisfactory as the industry would have liked. Steel plate in particular caused trouble and by the end of the year there were signs of steel deliveries lengthening again. A joint committee of the Association of British Chemical Manufacturers and the B.C.P.M.A. on standardization and simplification of chemical plant and equipment made considerable progress, and on the recommendation of the committee the British Standards Institution was asked to prepare a standard for sight and light glasses based on a range of recommended sizes, and a code for the vacuum testing of vessels to cover recommended ranges of vacuum. Among other matters receiving the committee's attention at the end of the year were standards for dust-proof electrical gear and the standardization of manholes and covers.

The report records that the demand from overseas for capital equipment continued throughout the year, and chemical plant exports were higher than in 1953, despite increased competition. It was gratifying to find evidence that the industry had recovered much of the goodwill it had lost in recent years through late deliveries caused by factors beyond its control. Board of Trade figures showed that exports of gas and chemical machinery totalled 7,598 tons in 1952, 6,588 tons in 1953, and 7,242 tons in 1954, of total values of £2.21 mill., £2.23 mill., and £2.44 mill. respectively. As the question of export incentives became less important, so more attention was directed to that of the credit facilities available to British exports, it being considered in many quarters that these were inferior to those which their competitors could obtain. By the end of the year, however, United Kingdom export credit facilities had improved and there had been some contraction in those available to exporters abroad. In particular it was the opinion in some well-informed quarters that the German exporter no longer enjoyed any special advantages over his British rival in this respect. During the year the Association helped a number of members on questions of export credit guarantees and of export finance generally.

The City and Guilds of London Institute has prepared a two-year part-time Final Grade Course in Furnace Brickwork which is intended for journeymen and apprentice bricklayers whose work is largely concerned with refractory and other brickwork in connection with the construction, maintenance and repair of furnaces, kilns and retorts, and their ancillary structures. Students entering for the course will normally be expected to have successfully completed the intermediate stage of the Institute's course in brickwork, or a course of equivalent standard. The scheme will come into operation in the college session 1955/56 and the first examination will be held in 1956.

Election of Three Honorary Members

LONG and valuable service to the Institution of Gas Engineers in particular and to the gas industry in general was recognized by the election of three Honorary Members at the annual meeting at Southsea on May 24. The bylaws of the Institution describe Honorary Members as 'persons eminent for science, combined with experience in pursuits connected with the gas industry,' and the three new additions to the distinguished list are well qualified. They are COLONEL W. MONCRIEFF CARR, C.B.E., T.D.; MR. T. CAMPBELL FINLAYSON, M.SC., M.I.CHEM.E.; and COLONEL W. R. GLOVER, C.M.G., D.S.O., T.D., J.P.

COLONEL W. M. CARR

COLONEL W. MONCRIEFF CARR, C.B.E., T.D., was born in 1886 and was educated at Manchester University, Owens College, where he took the Engineering Certificate. He was afterwards pupil under the late Lieut.-Colonel J. Mitchell Moncrieff, C.B.E., Civil Engineer, of Newcastle, and was engaged in bridge and dock construction work. In 1907 he joined his father, the late Mr. Isaac Carr, in his gas and water consulting engineering practice and assisted in the design and construction of a number of new gasworks. In 1911, Colonel Carr, while continuing his consulting work, became Engineer and Manager of the Ormskirk District Gas Company, and in 1922 he was appointed Engineer and General Manager of the Stretford and District Gas Board.

After 13 years successful work at Stretford he was one of the founders of the United Kingdom Gas Corporation, one of the first and the largest of the gas holding companies. In the same year—1935—he was elected President of the Institution of Gas Engineers. He remained at Stretford until the end of 1936, when he resigned in order to devote his whole attention to the United Kingdom Gas Corporation, of which he had become Managing Director. He continued in that office until the death of Mr. R. B. Ottley, whom he succeeded as Chairman of the Corporation.

Since the early days of the first world war Colonel Carr has taken an active interest in the Territorial Army. He was appointed Honorary Colonel of the 55th (West Lancashire) Divisional Engineers, Territorial Army, in 1934. He received the rank of Brevet-Colonel in 1930, was awarded the Territorial Decoration in 1929, and the O.B.E. (Military Division) in the 1936 Birthday Honours. Colonel Carr became Chairman of the North Western Gas Board at vesting date. He was awarded the C.B.E. in the 1950 Birthday Honours and in that year retired from the North Western Board.

MR. T. C. FINLAYSON

MR. THOMAS CAMPBELL FINLAYSON is Chairman of Woodall-Duckham Construction Co., Ltd., the operating company of the Woodall-Duckham Group and Chairman of Woodall-Duckham, Ltd., the holding company of the group. Educated at Manchester Grammar School and Manchester University, he obtained Honours B.SC. in Metallurgy and M.SC. for research work carried out for the Woodall-Duckham Company on methods of obtaining cheap industrial oxygen. During the 1914-18 war he worked for the Department of Explosives, Ministry of Munitions, on control of process efficiency by statistical methods.

Mr. Finlayson was on the design and development staff of the Woodall-Duckham Company from 1921 to 1941, being responsible for 10 years for co-ordination of the Company's design practice. In 1941 he was appointed Director-in-Charge of the design and development and operating departments and of the laboratories. He became Technical Director in 1943 (in succession to Sir Ernest Smith), Deputy Chairman in 1948, and Chairman in 1950.

Mr. Finlayson has served on the Councils of the Institution of Gas Engineers, the Gas Research Board and the Institution of Chemical Engineers. He is a Member of the Iron and Steel Institute and a Fellow of the Institute of Fuel, author of many technical contributions and holder of both the Institution Gold Medal and the H. E. Jones London Medal.

Colonel W. M. Carr, C.B.E., T.D.

Mr. T. Campbell Finlayson, M.SC., M.I.CHEM.E.

Colonel W. R. Glover, C.M.G., D.S.O., T.D.

COLONEL W. R. GLOVER

Colonel W. R. Glover is Chairman of Glover & Main Ltd., and Justice of the Peace for the County of Middlesex. He was born in 1882 and was educated at Uppingham School (1895-99) where he was a member of the rugby fifteen. He joined Thomas Glover & Co., Ltd., in 1900 as an apprentice under his uncle, the later J. G. Glover. He is himself a grandson of Thomas Glover, the founder of that Company.

Following the completion of his apprenticeship, in 1905 Colonel Glover became Manager of the Company's Birmingham branch and was appointed a Director in 1910. In 1914 he took over the management of the Edmonton works of Thomas Glover & Co., Ltd. After service with the Forces from 1914 to 1919 he was in 1919 appointed Managing Director of Thomas Glover & Co., Ltd., on the retirement of his cousin, Thomas Glover, and occupied this position until 1953. In 1949 he was appointed Chairman of Glover & Main, Ltd., and the trading companies.

On leaving school he joined the Volunteer Battalion, and throughout the 1914-18 war served with the then 1st London Battalion of the Royal Fusiliers (now the 8th Battalion) and was awarded the D.S.O. He became the Battalion's Honorary Colonel in 1949. Colonel Glover joined Rosslyn Park Rugby Football Club in 1899 and was its President for 1950-51.

A Past Master of the Haberdashers Company, Colonel Glover has been a Governor of four of the Haberdashers Schools since 1939. These are the Monmouth School, the Monmouth School for Girls, the Jones West Monmouthshire School for Boys at Pontypool, and the Adam Grammar School for Boys at Newport, Salop. He was initiated into the Murdoch Lodge in 1911 and is a Past Master of that Lodge and of Lodge No. 26, and is also a Past Grand Steward. He became a Member of the Institution of Gas Engineers in 1931.

The New President and Vice-Presidents

W. K. Hutchison, President of the Institution, 1955-56.

H. F. H. Jones, who becomes Senior Vice-President.

Dr. J. Burns, the newly-elected Junior Vice-President.

THE 1954 INSTITUTION MEDALLISTS

THE presentation of medals in recognition of outstanding merit in papers presented during the past year was as usual a feature of the opening session of the Institution meeting. The Institution Gold Medal, the premier annual award for the best paper, was awarded to A. R. Bennett and Dr. H. Reichert, of Radiation Ltd., for their paper on 'Disposal of Products of Combustion from Gas Appliances' presented to the 20th Autumn Research Meeting held in London last November.

The H. E. Jones London Medal was awarded to G. le B. Diamond, Chairman of the West Midlands Gas Board, for his paper on 'The West Midlands Approach to the Gasification of Residual Oils' to the Autumn Research Meeting. H. Stanier and J. B. McKean, who presented a paper on the closely related subject of 'Catalytic Gasification of Petroleum Oils' at the same meeting, had received a similar award a few years ago for their work on oil gasification.

The Institution Silver Medal for the best paper to a district section was presented to A. F. Grant, Secretary of the London and Southern Section, for his paper on 'Steam and Power at Bow Common,' which he gave to that section in January of last year.

The Institution Bronze Medal was awarded to K. Summersgill, of the North Western Gas Board, for a noteworthy paper entitled 'Some Aspects to Grid Interlinkage' which he presented to a meeting of the Manchester District Junior Association of Gas Engineers held at Stanton Ironworks in April, 1954. This was the second year in succession that the award had gone to a member of the Manchester District Junior Association.

The William Dieterichs Memorial Prize was presented to A. E. Tyrrell, of the North Thames Gas Board, for his paper on 'An Approach to Selling in Industry' read at the 1954 Industrial Gas Conference. Presenting this award, the President recalled the abounding ability which William Dieterichs, for some years Manager of Watson House, so enthusiastically gave to the service of industrial gas and said it was a particularly happy thought on the part of his former colleagues to establish the prize in his memory for an outstanding paper on a subject close to his heart.

A. R. Bennett.

Dr. H. Reichert.

G. le B. Diamond.

A. F. Grant.

K. Summersgill.

A. E. Tyrrell.

The President reads his address. On his right the Lord Mayor; on his left the new President, Mr. W. K. Hutchison, and Mr. A. R. McBain, Chairman of the Southern Gas Board.

The 92nd Annual Meeting

The 1955 Annual General Meeting of the Institution was held at Portsmouth and Southsea from May 24 to 27. For the whole of this period, the President, Mr. W. K. Tate, carried out his duties with an untiring spirit that fully maintained the tradition and standards set by previous presidents.

To begin the meeting, the LORD MAYOR OF PORTSMOUTH (Councillor G. A. Day, J.P.) extended a civic welcome at the South Parade Pier Pavilion, Southsea. He was pleased and privileged to give the official welcome, he said, the more so because the President was looked upon as a Portsmouthian, having been there for many years and having made his mark there. He trusted that the conference would be successful and that they would all enjoy their visit to the town. He would like to offer a special welcome to their colleagues and friends from overseas, who, he hoped, would be duly impressed by their wonderful city.

After the PRESIDENT had thanked the Lord Mayor for his welcome, the SECRETARY, (Dr. W. T. K. BRAUNHOLTZ, O.B.E.) read the notice convening the meeting.

The PRESIDENT, welcoming representatives and members from overseas, said the gas industry was world-wide in its activities and, as many presidents had done before him, he had been able during his year of office to travel about Europe and to see with great pleasure and admiration the advances which were being made in their industry in foreign countries. He welcomed particularly Mr. Robert W. Hendee, of Colorado, the President of the International Gas Union, M. Ferlet, the President of the French Gas Association, and the Vice-President, M. Nerot; Mr. F. C. Edmondson, the Vice-President of the National Gas Association of Australia; Dr. F. Gummert, the President of the German Gasworks Association; Mr. J. A. van Dijk, from Holland; Mr. N. V. Steenstrup, from Denmark; Mr. M. Schenker, of Neuchatel, Switzerland; Mr. Vaughan Chubb, of Newcastle, Australia; and an overseas member, Mr. R. C. Ruggles, of Bombay.

DR. BRAUNHOLTZ reported that greetings to the meeting had been received from Mr. Banks, the President of the American Gas Association; from the Austrian Gas Association; and from their old friend and Honorary Member, Colonel Zollikofer, of Switzerland.

The minutes of the 91st Annual General Meeting, held in Bournemouth from May 31 to June 3, 1954, and of the 20th Autumn Research Meeting, held in London on November 22 and 23, 1954, were taken as read, confirmed, and signed.

Report of the Council

MR. TATE moved, and Mr. J. H. Chapman, Wales Gas Board, seconded the adoption of the 92nd annual report together with the accounts for the year 1954. From the latter it could be seen that they were flourishing financially, said Mr. Tate.

Election of Officers

The SECRETARY announced that the Scrutineers of the Ballots for the election of Officers, Auditors, and Ordinary Members of Council had reported as follows:—

President, 1955-56.—William Kenneth Hutchison, C.B.E., Chairman, South Eastern Gas Board.

Vice-President, 1955-57.—Dr. James Burns, G.M., PH.D., Chief Engineer, North Thames Gas Board.

Auditors, 1955-56.—Colonel Sir Harold C. Smith, K.B.E., D.L., Chairman, Gas Council; and Peter D. Davey, F.C.A., Wood, Drew and Co.

Honorary Secretary, 1955-56.—G. E. Currier.

Ordinary Members of Council, 1955-58.—H. S. Cheetham, J. E. Davis, Harry Johnston and C. C. Wood.

The SECRETARY reported that all those whose names had appeared on the ballot list in connection with the election of Honorary Members, Members, Associate Members, and Associates had been duly elected.

The PRESIDENT said he could not let this item pass without a word of reference to the new Honorary Members, all of whom had rendered outstanding service not only to their Institution but also to the gas industry.

The SECRETARY reported the names of the District Members of Council nomi-

Left to right: P. D. M. Aird, Dr. A. B. Badger, Dame Vera Laughton Mathews, Colonel W. R. Glover and Mrs. Glover.

nated by the District Sections of the Institution and affiliated District Gas Associations for the year 1955-56. He also said it was proposed that the following four gentlemen should act as scrutineers of ballots for the ensuing year:—W. B. Claridge, J. E. Davis, J. M. Webber and C. C. Wood. The President formally moved their appointment and the motion was seconded by Mr. A. H. Nicholson.

Mr. and Mrs. H. G. Burgess.

Presentation of Medals

The PRESIDENT: 'We now come to the pleasurable and delightful task of congratulating all those who have earned outstanding distinction in the past year through the presentation of papers to the Institution and to associated bodies. I am delighted, because of my firm view that the Institution should cover a wide field of topics, that the Council have bestowed their awards in accordance with that principle.

The Institution Gold Medal is the premier annual award for the best paper put before the Institution in the preceding twelve months. The Council are delighted to award this medal for a paper of intense importance to the gas industry in its striving after improvements in utilization, since success here is one of the essentials for our continued development. The authors' contribution to our knowledge in this direction is very valuable indeed, as is only to be expected when we recognize that they have been working under the aegis of Sir Harold Hartley himself. It is an added pleasure to make this award to gentlemen who come from a sister part of the industry, the contractors. The award is made to Mr. A. R. Bennett and Dr. H. Reichert for their paper on 'Disposal of Products of Combustion from Gas Appliances' read at the 20th Autumn Research Meeting on November 22 last.

'The H. E. Jones London Medal is awarded annually for papers presented to the Institution on matters which embrace the basic principles which underly our processes and our conduct of affairs in the gas industry. A few years ago this medal was presented to Messrs. Stanier and McKean for their work on oil gasification. Events have moved rapidly since then, and at the 20th Autumn Research Meeting in November last we were privileged to hear a masterly contribution on this subject from a distinguished member of our Institution, Mr. G. le B. Diamond the Chairman of the West Midlands Gas Board, in which the basic limitation of oil availability and the trials of the early Onia-Gegi and other systems in this country were surveyed in an outstanding manner. I know that you will applaud the Council's decision, that I should ask Mr. Diamond to accept this medal for his paper entitled 'The West Midlands Approach to the Gasification of Residual Oil'.

The proper utilization of steam and the production of power in gasworks are subjects of immense concern to all engaged in the economic control of gas-producing stations and, since Mr. Birks presented his notable paper on the subject, we and associated bodies have received a number of most thoughtful contributions. I now have pleasure in presenting the Institution Silver Medal for the best paper read to a District Section of the Institution during 1954 to Mr. A. F. Grant for his paper on 'Steam and Power at Bow Common', which will hold a worthy place among its predecessors on this important aspect of our work.

The Institution Bronze Medal for 1954 has been awarded to Mr. K.

The Derby or the Strike?

Mr. H. Butters, of the North Western Gas Board, centres a cheery group.

Summersgill, of the North Western Gas Board, for his paper on 'Some Aspects of Grid Interlinkage'. This is the second year in succession that a paper presented by a member of the Manchester District Junior Association has been judged the best given to the juniors. The future in the North West would seem to be bright, with so talented a generation ready to follow after those now serving in the senior positions.

We all remember the late William Dietrichs and the abounding ability which he so enthusiastically gave to the service of industrial gas. It was a particularly happy thought by his one-time colleagues to establish the William Dietrichs Memorial Prize in his memory. The prize is awarded from time to time for an outstanding paper on a subject close to his heart. On this occasion I had no difficulty at all in accepting the recommendation of the appropriate panel that the prize should be awarded to Mr. A. E. Tyrrell, of the North Thames Gas Board, for his thoughtful and challenging paper entitled 'An Approach to Selling in Industry.'

The PRESIDENT presented the medals and prize to the recipients amid applause.

Presidential Address

MR. TATE at this stage delivered his Presidential Address, which was published in full in the 'GAS JOURNAL' of June 1.

W. A. P. Hoskin and G. A. Hunter, Past and Present Presidents of the Coke Oven Managers' Association.

MR. J. H. DYDE (Past President, Deputy Chairman, Eastern Gas Board), in moving a vote of thanks on behalf of his fellow members to the President on the most important occasion of his year of office, said it was a pleasure and a privilege. It was particularly so to him, because he had known Mr. Tate for as long as he had been in the gas industry. They were colleagues in the old South Eastern Gas Corporation days and had served together on many committees covering a wide field of interest. He could claim, therefore, to know something about him, and he confessed his admiration for the sterling qualities which had brought him, at the earliest age so far, to the honoured position of President of the Institution. The responsibilities of office had added lustre to those qualities, and they were now shared among a greatly enlarged circle of his friends, not only in the Institution but in the industry as a whole.

Left to right: W. Kirk, J. Ford, G. E. Anderson, E. G. Smith.

They learnt to expect much of him, and he had given them an address of admirable quality. His penetrating thought was clothed in a richness of phrase which was the envy of those who found it difficult to give expression to their thoughts, but the delight of all those who listened. His words, like so many nimble and aery servitors, tripped about at his command.

To know more about a man it was interesting to consider his hobbies. Kenneth Tate delighted in sailing small boats and in running model railways; indeed, railways of all kinds fascinated him. Surely the first of those pursuits characterized the self-reliance and individualistic approach which he always adopted to the many problems which confronted him, while the second revealed not only a mechanical mind but one which saw the whole picture in perspective and marshalled facts in correct and orderly sequence. He had given a masterly survey of the industry's position and outlook. There was realism in his exhortation to his fellow gas engineers always to consider projects in the merciless light of pounds, shillings and pence, so that efficiency might be evaluated in terms not only of process but of finance. His theme was that the industry must, as always, depend on its principal indigenous fuel, coal. His visits abroad had given him confirmation of the desirability of using new techniques, but he had emphasized that these should be applied to the use of coal rather than to the extended use of alternative fuels such as oil. He saw the present system of carbonization being gradually replaced by complete gasification, and he would find an increasing body of opinion ready to support his judgment. This was important, as there might be, perhaps, a reactionary tendency to swing too much to oil, particularly under the souring influence of coal shortage created by industrial unrest and the equally natural tendency to self-preservation by increasing the use of alternative raw materials from which gas could be made.

Mr. J. A. van Dijk (Dutch Gas Association).

J. E. Tully and G. V. C. Davies.

Here again his railway hobby came to

Technical and Planning Team of the North Western Gas Board.

the fore, as he gave warning that the railways were likely to be very big consumers of oil, perhaps to the detriment of availability to the gas industry. He made, however, the novel suggestion that the industry might employ its own tankers to bring crude oil to this country, and he was bold enough to support the idea of bringing liquid gas to Britain from Arabia if the search for natural gas should prove fruitless.

Of great practical value were his suggestions and ideas in pointing out ways of providing more coke for the domestic market, and he had advanced the view that the industry should turn its attention to the production of other solid fuels, hitherto the prerogative of the National Coal Board.

Interesting and extremely rewarding would be the further study of his address, because there was scarcely an issue of any importance to their industry upon which he had not dwelt and, with a logical analysis of the facts, presented them with a point of view.

Mr. Dyde thanked the President on behalf of all the members for his stimulating address and for the unremitting energy which he had shown throughout his year of office in visiting the district sections and affiliated bodies and in doing so advancing in his own inimitable way the objects and purposes of their Institution. In the precincts of their headquarters at Grosvenor Crescent they acknowledged with gratitude his wise counsel and conduct of affairs.

MR. H. S. CHEETHAM, seconding the vote of thanks, said the President had begun his address by drawing a contrast between the permanence of the Institution and the transiency of its presidents. He would, however, like to assure him that they would remember him for his generous service to their Institution and for the excellent manner in which he had conducted its affairs during his year of office. The President had drawn attention to the present need for economy and specialization, although he accepted the necessity with some reluctance for the latter. Mr. Cheetham said he shared his feelings, believing as he did that the changes in their industry were such that they could not have economy without specialization. That applied particularly, he thought, to his part of the industry. Specialization was, in his opinion, inseparable from the future prosperity of the gas industry.

He was glad that the President referred to the International Gas Union and the desirability of closer association between gas engineers not only in European countries but also in the U.S.A. Speaking as one who had some active association with those in the gas industries in other countries over a considerable period of years, he was sure that he was right and that nothing but good could come from interchange of young professional gas engineers.

Looking to the future of gas manufacture, the President had said, in effect, that they were in a changing world and must be prepared to deal with any situation that might develop. They must be able to utilize with efficiency whatever feedstock might be available to them, whether it be solid or liquid. They were all conscious of this need for flexibility, and he ventured to suggest that, with the notable contributions which were being made by engineers in all parts of their industry, they would not be found wanting.

A heavy and widely varied programme of technical sessions, visits, and social events followed. Six of the eight papers presented to the meeting are published in brief abstract in this issue; the other two will follow in a later issue. We also publish descriptions of the four principal works visited during the week

L. P. Ingram, J. T. Haynes, and F. D. Drake.

—the Fawley Refinery, the Totton Tar Works of South Western Tar Distillers, and the Southampton and Hilsea gasworks of the Southern Gas Board—and briefer references to the other visits.

The reception and dance was held at the Savoy Ballroom on the Tuesday evening, and a civic reception was given by

Mr. and Mrs. G. G. Warne and Mr. P. F. Smart.

the Lord Mayor and Corporation of Portsmouth in the South Parade Pier Pavilion on the Thursday evening. The Friday was devoted to an all-day cruise and visit to Cowes, with luncheon by invitation of the Southern Gas Board at the Central Gasworks at East Cowes, now under construction.

In accordance with custom, the Council sent a message of loyal greeting to the Queen. At the Wednesday morning session Mr. Tate reported the following reply from Buckingham Palace: 'Please convey to the members of the Institution of Gas Engineers, meeting for their 92nd annual meeting, the sincere thanks of the Queen for their loyal message, which Her Majesty greatly appreciates.'

There was also a message from the President of the Belgian Gas Association which read 'Best wishes for a bright and successful meeting.'

J. G. Tilley, W. Foster, J. M. McLusky, B. C. Morton, N. G. Appleyard, and N. C. Sturrock.

Votes of Thanks

At the closing session of the meeting on the Thursday morning MR. T. C. BATTERSBY proposed the customary vote of thanks to all who had contributed to the success of the meeting. Mr. L. J. L. WALKER seconded, and the motion was carried with acclamation. Those included in the vote of thanks were the Lord Mayor and Corporation of Portsmouth, the Southern Gas Board, representatives from overseas, the Staff of the Portsmouth and Southsea undertaking of the Southern Gas Board, the Admiral Superintendent, H.M. Dockyard, Esso Petroleum Co., Ltd., South Western Tar Distilleries, Pirelli-General Cable Works, Ltd., De Havilland Aircraft Co., Ltd., Brickwood and Co., Ltd., John I. Thornycroft and Co., Ltd., Cunard Steamship Co., Ltd., British Railways (Southern Region), Johnson and Johnson (Great Britain), Ltd., Leethems (Twilfit), Ltd., ladies and gentlemen assisting in the conduct of the meeting, the authors of papers, the scrutineers of the ballots, the officers, auditors, Council and committees of the Institution, and the Secretary and staff.

MR. W. K. HUTCHISON (President-Elect), who proposed a vote of thanks and presented the Presidential Certificate to the retiring President, Mr. W. K. Tate, thanked him for his tireless efforts on behalf of the Institution during the whole of his term of office. It took five or six years, he said, to reach the position where they both stood that day side by side, and those years were a period of intense grooming by 'Schoolmaster Braunholtz,' where Presidents were made. In five or six years one got to know a great deal about a man, and all those who worked with Mr. Tate had the highest regard for his great qualities, which were the qualities which every engineer of the highest standing should have—sincerity, singleness of purpose, and economy of words.

MR. J. F. RUST, who seconded, thanked Mr. Tate for a job well done and wished him every success in his future work.

The vote of thanks was carried by acclamation, and MR. TATE, in reply, paid a tribute to the support which Sir Harold Smith had given to the autumn and annual meetings and throughout the year. It was a tremendous joy to the President, he said, to feel that Sir Harold Smith and his colleagues supported the Institution and appreciated what they did. They were very anxious to do everything they could, and might sometimes be a little impatient at not being asked to do a little more.

A thoughtful platform: D. Beavis, E. M. Edwards, D. D. Melvin, W. S. Hubbard, R. H. Griffith, G. E. Anderson, W. R. Garrett.

THE INSTITUTION BENEVOLENT FUND

THE annual general meeting of the contributors to the Benevolent Fund of the Institution of Gas Engineers was held on May 25, in the South Parade Pier Pavilion, Southsea. Mr. W. K. Tate, President of the Institution, occupied the chair, and moved the adoption of the annual report and accounts.

In doing so he pointed out that the subscription income for the past year, at £1,931 was, he believed, the highest ever achieved. Similarly, the percentage of members of the Institution contributing to the Fund, 56.3, was the largest; but it would be agreed that they had no grounds for complacency in those figures, since no one could be satisfied with the fact that 40% of the membership did not see fit to give anything from their prosperity for the benefit of those who, through no fault of their own, had fallen on ill times.

He was sure that there was no need for him to draw their attention to the increasing burden of the general cost of living on those who must rely on pitifully small fixed incomes. All present would always continue to try to impress on the 40% of the members who did not subscribe to the Fund the desirability and indeed the necessity of doing something to help those who were so badly placed. They would be pleased to hear that, because of their rather improved finances at the moment, they had been able in the current year—which was not, of course, the year under review—to increase the generality of the grants to beneficiaries above the levels at which they had hitherto stood; and that, he was sure, would give them all as much pleasure as it had given the Committee of the Fund. The extent to which they could hold those increased benefits, and indeed improve on them, rested and must inevitably rest in the hands of the members.

MR. J. W. TOWNSEND, who seconded, said the gas industry had always been known as a friendly industry. Other industries in which one met people occasionally commented on the fact. That being so, and their reputation being good outside, it was a little shocking and saddening to notice, first of all, how few members had thought fit to remain for the meeting and, secondly, to think what a large number of them did not care what happened to their less fortunate brethren. The Committee of the Fund had an anxious task, and for several years succeeding Chairmen had made appeals, supported by various publicity drives. The District Sections of the Institution had had campaigns. All that they had managed to achieve, however, was that 56% of the membership of the Institution subscribed to the Fund.

In the list of contributors not every amount had an asterisk against it, indicating the signature of the covenant. That was one thing at any rate which members could deal with themselves. The other thing that they should do was to go through the list and see how many names of their friends and acquaintances did not appear in it, and then get hold of them and get them to do something about it. It was shocking that such a large number were not doing anything to help the unfortunate.

DR. BRAUNHOLTZ reported that as the result of the ballot for elections to the Committee of Management for 1955-58, Mr. W. D. King and Mr. G. E. Anderson had been duly elected.

MR. J. M. WEBBER, who moved a vote of thanks to the Chairman, Committee of Management, visitors and Hon. Secretary of the Benevolent Fund, said those who had at one time or another had an opportunity of watching the Committee in action realized not only that there was a great amount of work involved but that many of the decisions which had to be taken were most difficult, and were more difficult than they should be, because not only had the Committee the invidious task of weighing up the rival claims made on the Fund but they also had to have regard to its all too slender resources. Apart from a vote of thanks, the most sincere and practical tribute which could be paid to the officers would be to 'put a little more money on the favourite.'

MR. S. W. SUTCLIFFE seconded the motion, which was carried, and Mr. Tate briefly replied.

Delegates from overseas.

ACCELERATED CONTINUOUS CARBONIZATION*

By W. Hodkinson, O.B.E., M.Inst.Gas E., M.I.Chem.E.†, T. Nicklin, M.Sc.(Lond.), M.Inst.Gas E., A.M.I.Chem.E.§, and M. Redman, B.Sc.(Tech.), M.Inst.Gas E., A.R.I.C., A.M.I.Chem.E.¶

WITHIN the last 14 months a great deal has been written, and probably even more said, about the system of carbonization, which, in the North-West, has come to be known as the 'Rochdale' Process; indeed, this is the fifth paper on the subject within that short space of time. The system has also assumed many titles, and, while the authors do not accept the suggestion put forward by a speaker at a recent conference that it was either a 'revolution' or a 'red herring' and would far prefer their own North Western title, for purposes of technical lucidity they have used, on this occasion, the term 'accelerated continuous carbonization.'

When Messrs. Nicklin and Redman presented the first paper on this subject to the Manchester and District Section of the Institution, they indicated that development work on the process started in the North-West as long ago as 1950, and, was initiated in an attempt to find means of alleviating inflationary pressures which, at that date, could be foreseen by those of us responsible for placing the production and distribution systems of the industry on a sound basis.

In the 1930's, when gas undertakings were bought and sold freely the people responsible for the valuation of gas undertakings developed, when examining the operations and results of such undertakings, a sense for recognizing a series of warning lights. Of these, two of the most important were capital employed in the undertakings in relation to the condition of the assets offered for sale, and the trend of consumption per consumer. It is suggested that under present conditions both of these lights are set at amber in the industry today, and indeed, the inflationary pressure of capital charges will continue to increase for several more years and may well be of almost equal significance to the increase in net cost of our labour and raw materials. It will be recalled that the Chief Accountant to the Gas Council directed attention to this matter of capital charges at the Annual Meeting of the Institution in 1954.

In the old days many undertakings were bought even with this light beaming red from the top of the gasholder, always provided that there were available at least two of three solutions. These were: first, to improve the productivity from the assets taken over by increasing efficiency and output; second, to buy gas in bulk at reasonable prices from adjacent sources, so turning the undertaking into a retail organization, and third, to develop a market for gas as quickly as possible generally in the industrial and commercial field.

In the North-West we are not over-anxious to turn ourselves into large-scale retailers, because past experience has indicated the difficulties associated with the maintenance of good service to our consumers in the absence of control over the manufacture of the product we sell, and here the gas industry varies quite materially from the usual type of retail trades in that we have to live with our consumers day in and day out, and in their eyes, we are expected to provide not just a product but a satisfactory heat service.

The development of the process of accelerated continuous carbonization in the North-West, was required, and will be used, to enable the Board to develop large-scale industrial and commercial loads at prices which could not be achieved if we had to build new gasworks to meet the load, yet will show a fair margin of profit which, in its turn, will facilitate the introduction of truly promotional tariffs for the domestic consumer, where it is suggested that the second light is also set at amber.

The gas industry is in dire need of increased sales accompanied by low capital expenditure and, while, at this technical meeting, we may examine this process of accelerated continuous carbonization from the point of view of technicalities, thermal efficiencies and the like, its value in the North-West is the facility it provides to further develop our load. In my view the overall economics of this problem are such that we could in fact afford to lose some slight *thermal* efficiency on our gasmaking process, if, in so doing, we materially increase productivity and reduce capital commitment in meeting the load.

Technical Aspects

Turning to the technical features of the process, in the introduction to the paper we describe the mechanical points of the conversion system installed on the bench of 16 retorts at the Partington works and, as indicated, as a result of that experience we have developed a number of modifications leading to appreciable simplification of design and consequent reduction in cost per unit. It should, of course, be appreciated that this installation was designed for closely controlled experimental work and for that reason was somewhat elaborate. The second conversion now to be carried out on the second bench of 16 retorts in the same house at Partington, will conform to what we consider adequate for the normal operation of the process. Incidentally, we hope that this further installation will be at work by the end of this year.

Description of Plant

In the earlier paper describing the initial development work, intimation was given of the proposal to conduct full-scale tests on a complete bench of retorts, when operating the 'Rochdale' Process, in order to find out whether the pilot-plant results were confirmed and what other problems were involved. In the paper, it was pointed out that the successful application of the 'Rochdale' Process on the large scale appeared to be dependent on the following three important factors:—

(1) That there should be no leakage of the injected gas from the bottom ironwork to atmosphere or from bottom ironwork and lower retort brickwork into the combustion chambers and secondary air preheating flues.

(2) That the travel of the coal charge would have to be carefully watched since, should interruptions in travel occur, more serious complications than normal would ensue because of the greater extraction rate. Such considerations implied that good top rodding was essential; alternatively, the travel of the charge would require improvement by mechanical or other means.

(3) That the gas and coke yields should not be materially worse than in normal operation.

The bench where the full-scale tests have been implemented is at the Partington gasworks, Manchester, and consists of 16 82-in. Woodall-Duckham lambently heated retorts, which were new in 1952. There is a second similar bench. During quantitative test runs, no gasmaking is conducted on the latter, since the gas cannot be metered separately. The benches can be fired from separate Humphreys & Glasgow mechanical producers so that accurate producer fuel figures may be obtained.

The only modifications made to the bench comprised the equipment to inject the gas. It was desired to inject blue water gas, coal gas or mixtures of the two. Accordingly, a supply of cooled blue water gas was piped from the inlet of the water gas purifiers before the point of entry of the revivification air, and coal gas was taken from the outlet of the static ammonia washer on the Woodall-Duckham gas stream. Each supply passes through Connersville meters. The coal gas then passes through a further measuring orifice and a Reynolds-type volumetric governor before meeting the blue water gas supply, which has passed an orifice and a constant-outlet-pressure governor. The combined 24 in. gas main after

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this point constitutes an inlet manifold to 16 4-in. volumetric governors, which keep the gas rate to each retort constant at any predetermined figure.

Each of the 16 4-in. feed lines is fitted with an orifice plate actuating a flow indicator in 12 instances and flow recorders in the other four cases. The recorders were installed for experimental reasons, and to obtain records of the performance of the volumetric governors, since these operate on unpurified gas.

There is recording, indication and integration of flow for each of the blue water gas and coal gas main streams, together with a pressure record, and also a summation of the two by a recorder and an indicator. (It is necessary to electrically summate the two flows owing to the variations in specific gravity that can occur when different proportions of the two gases are used for injection.) By setting the large coal gas volumetric governor to any given flow, the additional blue water gas required to satisfy the individual retort volumetric governors is supplied through the constant-pressure governor. In this way, a fixed coal gas to blue water gas ratio may be maintained, except at retort discharging times whereupon the gas is shut off each retort in turn, and this reduces the blue water gas flow only. When adjusting the ratio, it is only necessary to check that the total flow of gas remains the same. All the equipment, with the exception of the Connersville meters, is within the existing retort house. Each retort is fitted with its own recorder to measure the pressure in the bottom coke chamber. The whole of the installation is of cast iron and steel construction in view of the fact that the gas contains hydrogen sulphide. The only exceptions are the valves in the small volumetric governors, which are of aluminium alloy.

When discharging the retorts, it is necessary to steam purge after shutting off the gas and before opening the door and again after closing the door, before the gas is turned on again. This involves the use of interlocking gear, which may be mechanical, electrical, hydraulic or pneumatic in design. A system employing electrical and hydraulic operation has been installed at Partington. It was considered that hydraulic operation of the doors and valves constituted an easy means of providing full interlock facilities, without interfering with access to any part of the retort bench, and would reduce the labour requirements. This was desirable since hourly discharging would be required.

Later modifications have resulted in appreciable simplification, and the gear now comprises only the control box, the door crank and cylinder with interlock switch, and a combined four-way gas/steam valve with interlock switch or, alternatively, separate gas and steam valves ganged together. The normal extractor gear is used, the speed of the reciprocating bars being increased by means of a variable-speed gearbox. The whole installation was designed for experimental work, and on this account is more elaborate than would be necessary for a normal commercial installation.

The implementation of accelerated continuous carbonization by the 'Rochdale' process on a commercial scale at Partington works has confirmed the preliminary work carried out at Rochdale gasworks, and has shown that the process can operate as a commercial proposition and that it can be operated under the conditions of labour and technical supervision that are found in the gas industry.

Increase in Output

The output from a continuous vertical retort can be considerably increased and coal can be carbonized at the rate of 1.8 to 1.9 ton per day per 10 in. of major axis. There is an increase of approximately 35 to 40% in coal gas therms made per retort, compared with the thermal output of gas when similar plant is producing gas at a calorific value of 450 B.Th.U. per cu.ft. under steaming down conditions at a coal throughput of about that recommended by plant contractors. With the addition of the blue water gas used for injection purposes and making gas at a final calorific value of 450 B.Th.U. per cu.ft., the output of the plant is approximately doubled.

The hydrocarbon enrichment value is not reduced and is the same at double the normal coal throughput. The thermal yield per ton of coal carbonized is slightly less at double throughput, but is at least as good as was predicted from the pilot-scale work.

Due to the lower efficiency of water gas production in external plant, the net coke yield at double coal throughput, after allowing for fuel and water gas consumptions, is reduced. This reduction is 0.6 and 0.7 cwt. per ton of coal carbonized, half of which appears as steam. The properties of the coke are not significantly changed, and there is no change in the amount of breeze formed. The producer fuel consumption per ton of coal is 50 to 60% of that used in normal operation to produce gas at a calorific value of 450 B.Th.U. per cu.ft.

Coal Travel

Coal travel through the retort is satisfactory and similar to that obtained under normal operating conditions, provided that trunk feeds are employed and the swelling number of the coal does not exceed 5. For higher swelling coals, further work is necessary to determine the effect on coal travel. As would be expected, under double throughput conditions any interruption in coal travel results in acceleration of associated difficulties arising from this factor.

Scurf formation with blue water gas injection and double coal throughput is not noticeably different from that when operating under steaming-down conditions. This, therefore, halves the scurfing needed per ton of coal and the coke consumption and loss of productivity which this operation entails. Normal coke-extraction gear when speeded up has been used without any difficulty. The flexibility of the process has been amply demonstrated by the fact that coal throughputs can be doubled immediately after applying the injection gas, and, conversely, the retort can be operated under normal conditions after shutting off the injection gas.

Degradation of Hydrocarbons

Under coal gas injection conditions, degradation of hydrocarbons occurs; this increases as the proportion of coal gas in the injection gas is increased. Using make-of-retort gas as the injection gas, the scurf formed is appreciable and reduces the period between scurfings to between one-fifth and one-quarter of that normally employed. The injection of complete-gasification gas would result in very little hydrocarbon degradation taking place. This degradation would appear to be of great importance, since the economic conditions favouring the use of such gas would minimize the cost of the small amount of degradation taking place.

When operating at lower combustion chamber temperatures, of the order of 1,050°C., it has been found that nominal coal throughputs may be carbonized. Quantitative figures under this method of operation have yet to be determined. Washed smalls can be carbonized at throughputs greater than when operating without injection gas.

It has been observed that the bottom ironwork is somewhat warmer than under normal operation, but is not, apparently, excessively hot.

Should the pressure at the bottom of the retorts exceed ½ to 1 in. w.g., gas leakage might occur, which could cause damage to the retort supporting structure. However, the possibility of such damage could be removed by modified construction at times of resetting and rebuilding. No modification has been found necessary to the gas offtake system to handle the gas under double coal throughput conditions.

Carbonization of Blends

Carbonization of coal blends appears to be practicable when certain difficulties have been overcome. These difficulties include the leakage of gas at the bottom casting joints, which must be eliminated. The coal blend must be pulverized in such a manner as to reduce the proportion passing through a 72 mesh.

The injection gas/coal ratio used in Test 3 (9,400 cu.ft. per ton of coal as received) was found to be insufficient, but the average bottom casting pressure was of the order of 1 in. w.g. Means have still to be found to increase the injection gas/coal ratio without increasing the bottom casting pressure. This implies operation to produce a lower calorific value of the final gas than is normal unless coal gas is included in the injection gas, whereupon degradation would occur.

In order to deal with the carry over of fine coal in the gas leaving the retort, a quantity of washing liquor far in excess of that normally employed must be sprayed into the gas stream before the foul main. Additional filter-settling tanks are required in order to enable the retort house circulating liquor to be clarified and recycled.

(*Concluded on p. 702*)

THE 'BACKBONE' MAIN IN THE EAST MIDLANDS AREA*

By E. W. Pickering, M.Inst.Gas E.† and J. B. Walsh, Assoc.M.Inst.Gas E.§

AT vesting date, the East Midlands Gas Board became responsible for an area diverse in character between the heavy steel industry of Sheffield and the agricultural expanses of Lincolnshire. The Sheffield area, with its considerable network of high-pressure coke oven mains, fed from a number of coking plants, was unable to meet the gas demand within the district. On the other hand, the Notts. and Derby division was just able to meet requirements by heavy production of water gas but could not meet known loads that were expected to become available within the next few years.

Both these divisions were extensively integrated between undertakings (due to their situation relative to the coalfields and because of the coking plants erected thereon by industry), but no inter-divisional link existed.

Comparatively, the Leicester and Northants. Division was more scattered as regards centres of consumption, and integration had taken place only in relatively isolated cases; in these cases the tendency was to form a few large manufacturing units both to eliminate the smaller, inefficient works and to effect economies in manufacture. The cost of gas into holders was, naturally, lowest in the two divisions situated in the coalfields, and was relatively high in the Leicester and Northants. Division and in the greater part of Lincolnshire. Two major coke oven developments at Stanton Ironworks and the Avenue plant of the National Coal Board, south of Chesterfield, both in the Notts. and Derby Division, raised the problem of where the gas released could best be utilized with economic advantage.

Differences in the calorific values of gas, arising from the coals carbonized in the Sheffield and Rotherham Division as compared with those carbonized in the southern parts of the area, had to be taken into account, as had the lower price of gas in the Sheffield and Rotherham Division; but, quite apart from the problem of calorific values, it was calculated that greater savings to the Board would result from sending gas and coke southwards to the Leicester and Northants. Division than from sending gas northwards to the Sheffield and Rotherham Division, where coke oven gas bought already approximated to 65% of total gas available for sale.

Economic Considerations

Consideration was, therefore, given to the economics of distributing those volumes of gas surplus to the requirements of the Notts. and Derby Division to the Leicester and Northants. Division, where the standardization of calorific values (which ranged between 450 and 500 B.Th.U. per cu.ft.) at 480 B.Th.U. per cu.ft., presented no great problem, and where sales expansion would definitely benefit from the availability of cheaper gas.

The three salient factors that entered into these considerations were:—

(1) The reduction in costs that would result from the import of coke oven gas, provided that the costs of distribution would not greatly offset the economies of the bulk purchase of coke oven gas.

(2) The quantity of gas likely to be available in the next few years was such that the cessation of manufacture throughout the Leicester and Northants. Division (with the exception of base-load plants at Leicester and Northampton) could be effected.

(3) The 'backbone' main feeding the Leicester and Northants Division should be of a capacity to allow for a complete cessation of manufacture when either:
   (*a*) existing base-load plants were worn out; and/or
   (*b*) sufficient gas was available on the coalfield to render them economically redundant.

As inter-divisional integration was being considered, it was essential that sufficient existing coal gas and carburetted water gas plants, which between them would make good any reasonable shorter-term deficiency of coke oven gas in the two divisions, were left in readiness for operation. It is interesting to note that the basic factor behind this investigation was the fundamental need to consider the availability of gasmaking plant and holder storage in its widest sense, namely, on a two-divisional basis. Coal gas costs, excluding capital costs, for the year ended March 31, 1954, in the Notts. and Derby Division and the Leicester and Northants. Division were, respectively, 6.789d. and 9d. per therm, the difference being due in large measure to additional cost of coal delivered remote from the coalfield.

The supply of future gas requirements for Leicestershire and Northamptonshire being manufactured within the Notts. and Derby Division was considered to be the economic future development, assuming no new methods of gas manufacture are introduced, and that no new sources of gas are discovered such as to change the present cost differentials.

Taking the total estimated gas demand for the two divisions for the year 1957-58—*i.e.*, when the full amount of coke oven gas is being absorbed, the production of coke oven gas to the total demand is estimated to be approximately 50%. A major problem confronting the Board was the completion of a heavy mainlaying programme, coupled with the installation of grid reception equipment in time to suit the coke oven construction programme.

Design of 'Backbone' Main

As complete integration of all undertakings in the Notts. and Derby Division had already been planned, and was nearing completion, prior to the advent of major grid developments (arising out of the coke oven gas programme), the position in this division resolved itself into the provision of adequate trunk mains to cater for the moving of large volumes of coke oven gas to the major centres of demand—*i.e.*, Chesterfield, Derby and Nottingham, and to make provision for delivering surplus volumes of gas from Derby to the Leicester and Northants. Division, where only a small amount of integration had taken place either prior to, or following vesting date. An essential part of the overall grid development was, therefore, a determination of the gas requirements of the Leicester and Northants. Division. By taking into account all factors which may influence gas consumption, an estimate of ultimate consumption was obtained which was used for undertaking and, collectively, divisional requirements.

Consumption Classification

It was essential that estimated consumption be compared with actual consumption year by year, and, with this in view, consumers were classed in accordance with the national return (G.Ret.1) on which official consumption returns are made. Details of the number of consumers, annual consumption in therms per consumer, and total annual consumption in therms were obtained under the following headings:—

Domestic consumers (ordinary meters).
Domestic consumers (prepayment meters).
Industrial consumers.
Commercial consumers.
Government departments.
Local Government establishments.
Public lighting.
Gas used (own purposes).
Total sales.
Unaccounted-for gas.

With these basic figures, estimates for each year up to 1971-72 were made, together with an estimate of demand covering a further 15 to 20 years known as 'long-term' requirements.

In each undertaking's estimate, the following points received individual consideration:—

Existing Domestic Consumers

Domestic consumer consumption varied in different undertakings between 92 and 134 therms per ordinary meter consumer, and 91 and 140 therms per prepayment meter consumer. Account was taken of such factors as a possible reduction in

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the price of gas, or, at least, a maintenance of present gas prices following the import of coke oven gas; existing pressure conditions; the quality of consumer service and sales promotion, and the degree of local prosperity.

Future Consumer Demands

Local authority programmes of building development and demolition, industrial and commercial surveys, together with an anticipated decrease in the consumption of gas for street lighting were all factors that were taken into consideration.

Gas Used for Own Purposes

The conversion of most works to holder stations and the electrification of boosters and compressors will result in this consumption being reduced in most cases to a purely nominal figure.

Unaccounted-for Gas

The average value for unaccounted-for gas at the time of the estimate was 8.6%. The closing of most works in the Leicester and Northants. Division, the installation of many new station meters and works connections, the more systematic replacement of defective mains and services, and the levelling of district pressures, are some of the factors that led to a long-term average unaccounted-for value of 6% being used in the estimate.

Estimated Gas Requirements

The estimated increase in the gas requirements of the Leicester and Northants. Division amounted to 62% by 1971-72, and 105% long-term.

Gasholder Capacities

As with all efficient grid systems, it was considered of vital importance that all grid-connected holders throughout both divisions be fully utilized by running down stocks Monday to Friday, and so making available at week-ends as much capacity as possible for absorbing base-load gas from both coke ovens and gasworks.

Route Problems

An initial survey of all main routes was made prior to sizing and costing the different main sections. The difficulties of finding a route and laying large mains through towns and villages are increasing, and wherever possible such conditions were avoided. Partly for this reason, and with the object of keeping the 'backbone' main itself to a minimum length, the route chosen involved large cross-country sections. It is interesting to note that, when the final survey was made preparatory to the preparation of route maps and specifications for mainlaying, only in one or two cases was it found impracticable to adhere to the original route due to difficulties regarding easements.

Pipe Sizing

It was decided, as a basic principle, that the grid main should be laid in a size sufficiently large to allow for a total cessation of manufacture in the Leicester and Northants. Division. All mains were sized on the basis of 20 hour pumping conditions within the safe working limits of spun pipes when carrying long-term loads, and the system was designed to attain its maximum economy under 1971-72 conditions of flow.

Pressure losses in each section of the grid main were examined individually, and pumping pressures were calculated to allow for a terminal pressure of 1 lb. per sq. in. at the extremities of the grid-main system. For estimation purposes, the average compressor efficiency was taken as 65%, and the overall electric motor efficiency as 80%. The cost of electricity was taken as 1d. per unit.

Spun Iron or Steel Mains

In estimating the pipe sizes for the 'backbone' main, it was found that, with the exception of the Derby to Leicester section, spun iron pipes could be obtained in suitable sizes and quantities to cover the range of ultimate working pressures needed, based, generally speaking, on 24-hour pumping from coke ovens and 20-hour pumping from gasworks, holder or recompression stations.

In designing the Derby to Leicester section, it was determined that the economic size of the main should be 27 in. dia. For the year 1971-72, an initial pressure at Derby of 46 lb. per sq. in. would be required, and, as this was above the maximum working pressure of a large spun iron main, a steel main was necessary. However, steel pipe was not available in sufficient quantity to enable the Derby to Leicester link to be constructed within the time limit imposed by the coke oven programme. It was also considered unnecessary immediately to embark upon the total capital expenditure of a 27 in. dia. steel main over the whole distance between Derby and Leicester, as the possibility of new sources of supply within the Leicester and Northants. Division could not be ruled out. In consequence, it was decided to lay that portion of the main from Derby to Kegworth, at the Leicester and Northants. Divisional boundary, in 27 in. dia. steel pipe, and the remainder in 24 in. dia. spun iron pipe. With this combination of main size, it will be possible to operate for many years within the safe working pressure range of the 24 in. spun iron section of the main.

Mainlaying Operations

The mainlaying programme was spread roughly over a four-year period culminating in a peak period during 1954 when a maximum mainlaying rate was achieved over the two divisions of some 10 miles per month. It was essential to achieve this and smaller peaks of mainlaying rates in order to be in a position to accept volumes of gas from coking plants and from the major carbonizing plant developments at Derby as they become available at specified dates. In other words, once the grid development had been decided upon it was necessary to plan the completion of certain sections of the grid system to fit into the overall plan of gas availability and demand.

Difficulties in meeting this programme were encountered, especially in relation to completion of the 11 miles of 27 in. dia. steel main laid across the valley of the Trent at Shardlow where constant flooding seriously hampered the work. At one period five contractors' gangs and one direct labour gang were engaged on the work to ensure completion in time for gas to be transmitted from Derby to Leicester by a specified date. In the Leicester and Northants. Division, where an extremely heavy mainlaying programme is under way, efforts are in being to reduce the planned completion date by six months.

One point in the matter of large scale mainlaying across country comprising farm lands is the use of suitable equipment. Arising out of experiences in both the Notts. and Derby and Leicester and Northants. Divisions, future specifications for this type of work are to provide for the use of 'Jubilee' tracks as opposed to tracked vehicles.

Although the use of 'Jubilee' tracks for cross-country mainlaying has greatly diminished in favour of the use of either rubber tyred vehicles or vehicles having 'caterpillar' tracks, it has been the authors' experience that these vehicles cause excessive surface damage to land during wet spells which results in considerable adverse criticism from landowners. Where, however, 'Jubilee' tracks were used by the contractor, the surface damage was much less and, indeed, landowners expressed unsolicited satisfaction with the work as carried out.

It can be noted from the paper that throughout the 'backbone' system the fullest possible use is made of the residual grid pressures, as, for example, at Derby, where the residual pressure on the many grid lines of 15 lb. per sq. in. will be utilized in transmitting gas to Leicester through recompression machines fitted in series. Used singly with 15 lb. per sq. in. on the inlet one machine will handle 1.2 mill. cu.ft. per hour against an outlet pressure of 23.8 lb. per sq. in. If necessary, this pressure of 23.8 lb. per sq. in. can again be used on the inlet to a second machine to give a total volume of 1.5 mill. cu.ft. per hour against an outlet pressure of 35 lb. per sq. in. Similarly, at Northampton, the ring main system which also feeds small holder stations and district governors will be fed by grid gas from Leicester augmented during peak hours by boosters at Northampton operating from holders.

The 'backbone' system as so far developed over two divisions of the East Midlands area measures approximately 90 miles in a north to south direction from Chesterfield to below Northampton, and is some 40 miles in extent measured in an east to west direction at the widest part—*i.e.*, from Grantham to Burton-upon-Trent. The consumers within this integrated grid area number approximately 650,000. Ultimately it may be considered economically advantageous to extend the present 'backbone' system northwards to Sheffield.

Control of Grid

In order that such an extensive grid system as the 'backbone' main could be operated at optimum efficiency, it was necessary to institute control of volumes passing throughout

(*Concluded on p. 731*)

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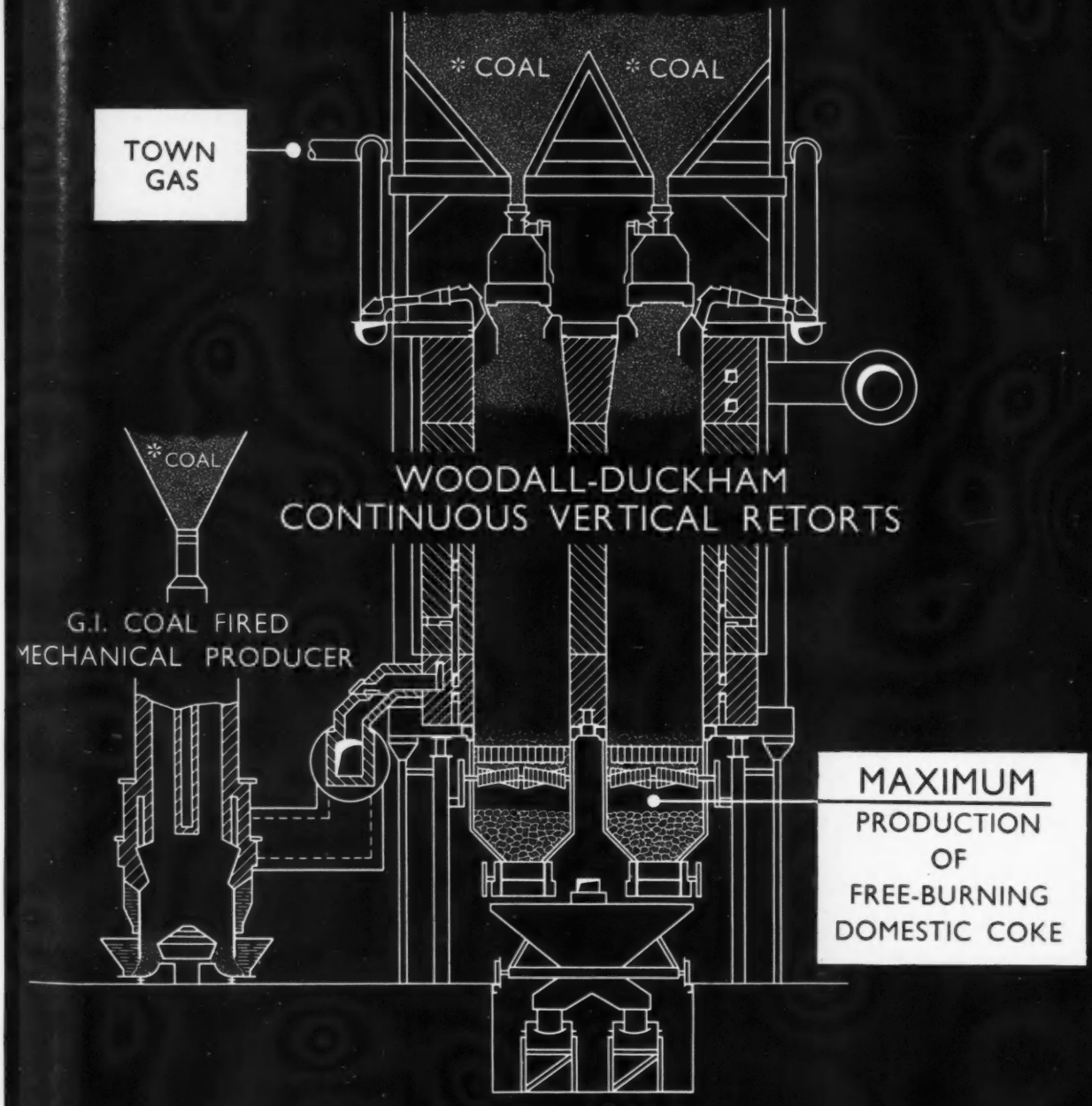

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Pumping of Liquids on Gasworks*

By L. J. Clark, B.E.M., M.Sc., M.I.Mech.E., M.Inst.Gas E.†

ONE of the attractive things about being a gas engineer is the fact that one is required to be a 'Jack of all Trades,' with a broad knowledge of basic engineering practice and, at the same time, a specialist knowledge of gas technology itself. Although most of our research and studies in the Institution of Gas Engineers is devoted to the science of gas engineering, I think it is sometimes worth while reviewing one of the basic engineering processes and relating it to the specific requirements of our industry. It is for this reason that I make no excuse for presenting a paper on this rather prosaic subject of pumping liquids in gasworks, although I am aware of inevitable shortcomings in dealing with so broad a subject in a limited space.

Although pumping machines have a long heritage from ancient civilizations, it is interesting to find what improvements to existing designs continue and how designs are developed. At the present time, the pump finds application in practically all industrial processes. As far as our industry is concerned statistics show that the water circulated and consumed in gasworks processes is approximately equal to the domestic consumption in the country. Expressed another way, the total weight of liquids pumped and circulated on the gasworks usually lies between 25 and 35 times the weight of coal carbonized.

The importance of pumps should not, therefore, be underestimated and it is sometimes disappointing to find that because of their inherent simplicity and reliability they have become the 'Cinderellas' of the works, being often neglected and left to run inefficiently. Steam pumps in particular are not only notorous for their extravagant use of steam but excessive losses are also incurred in the straggling steam services supplying them. In my view steam pumps can only be justified where the exhaust can be used for process purposes. The plume of steam from pump exhausts blowing to atmosphere should be as offensive to the gas engineer as a black smoking chimney.

A 6 in. bore steam pump continuously running will consume overall more than 20 shillings worth of steam per day, whereas the electrically-driven counterpart would cost about a quarter of this amount to run. The capital cost of the electrically-driven pump would be around £200, so that it is evident a new pump would pay for itself in less than a year. On modern works with electrically-driven pumps, liquids can be transferred at high efficiency and the power usage amounts to only some 1 to 2 kW. hour per ton of coal carbonized. This amount of power represents an overall utilization efficiency considerably higher than that normally achieved with the handling of solid materials.

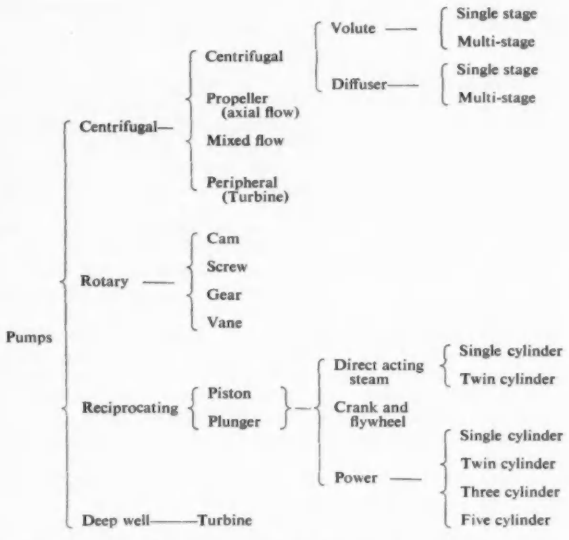
Selection of Types of Pumps

The gas engineer is not so much concerned with the detailed design of pumps, but he must be able to select the best type of pump for any specific duty. This requires a knowledge of the various types that are available, together with their operating principles and main performance characteristics. In the first place, it is necessary to have data on the following:

(1) Quantity to be pumped.
(2) Delivery head.
(3) Suction lift or head.
(4) Temperature of liquid.
(5) Viscosity of liquid.
(6) Corrosive characteristics.
(7) Presence and nature of solid materials, if any.
(8) Lubricating properties of the fluid.

In addition, it is usually important to know the degree to which the quantity and head may vary and also the overall load factor of the pumping duty.

Pumps have been classified by the Hydraulic Institute into the following categories:—



For the majority of gasworks duties the choice usually lies between pumps of the centrifugal and reciprocating types. In general, the former are most suitable for dealing with larger quantities of non-viscous liquids but they are usually restricted to medium pressure. On the other hand, reciprocating pumps are limited by their physical dimensions to certain maximum quantities but they are usually capable of operating at higher pressures than centrifugal pumps, especially in the smaller sizes. The approximate duty limits of the two types are shown in Fig. 1 of the paper, from which it will be seen that there is an intermediate duty range where the two types overlap.

Rotary pumps generally overlap the quantity range of reciprocating types, and while they have advantages of higher speeds, greater compactness and lower cost, they are usually limited to medium pressures and are most suitable for liquids with lubricating properties.

Efficiency

The efficiency of any pump varies inversely with its internal losses, arising through:—

(1) Hydraulic friction.
(2) Internal slip or leakage.
(3) Shock and eddy effects.
(4) Mechanical losses.

As a general rule, it may be stated that, as the velocity of fluid flow and mechanical movement in a pump increase, so do the losses arising from hydraulic and mechanical friction, and in many cases these are accompanied by increasing shock and eddy losses. The importance of internal slip, however, tends to diminish with increasing velocity, as leakage through clearance spaces is a function of the pressure differential, the escape area and the viscosity of the fluid, and for a particular pump these remain substantially constant regardless of speed. It therefore follows that for dealing with low viscosity fluids such as water, the higher speed pumps are likely to be more suitable and for most applications within the duty limits indicated in Fig. 1 the centrifugal pumps offer advantages of simplicity, cheapness and facility for direct coupling to an electric motor.

Centrifugal pumps have the peculiar non-positive characteristic which permits the fluid flow to be regulated by a control valve on the delivery line, and the quantity/head relationship of the pump will automatically adjust itself within the limits of the design to the overall resistance of the delivery system.

For the more viscous fluids, including heavy oil and tar, reciprocating and rotary types of pumps possess advantages as

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† Development Engineer, North Thames Gas Board.

lower speeds can be used, thereby counteracting the excessive fluid friction losses which would otherwise occur. In these cases internal slip becomes less important because high viscosity prevents excessive internal leakage even at low speeds.

Reciprocating pumps can deal with liquids having a wide range of viscosities provided the piston speed is slow enough to allow complete filling of the pump cylinder at each stroke. They are also positive in their action and the quantity delivered is directly related to speed and unaffected by pressure.

Centrifugal Pumps

Turning more particularly to centrifugal pumps, pressure energy is imparted to the fluid in two ways:—

(1) By direct pressure of the impeller vanes in accelerating the fluid, and

(2) by reconverting part of the kinetic energy so imparted into pressure energy by decelerating the fluid in a divergent passage.

The elementary hydraulic principles of these processes are common knowledge and by employing the well-known hydrodynamic laws, correlating pressure, quantity, density, viscosity and speed, the performance of any particular design of impeller and pump can be determined. In this way the entire performance characteristics of a particular pump design can be shown on one graph (Fig. 2 of the paper) correlating speed, head, quantity and efficiency. These relationships follow from the fact that the quantity delivered by a particular impeller varies directly as the speed, but the pressure head varies as the square of the speed. Such curves enable the performance of a particular pump design to be related to a specific application, and if the duty is variable, the effects on pump efficiency can be seen and the limits of performance readily revealed. Curves given in Fig. 3 of the paper show a comparison between three pumps of different basic characteristics, all capable of delivering a specified quantity and head at the corresponding duty point 'X', which would normally be designed to correspond with the resistance of the delivery system under the same flow conditions. If, however, the flow is reduced, the resistance of the system will follow the lower curve shown, while the pump pressures will rise, making it necessary to dissipate the difference in pressure energy through the delivery valve. For a duty requiring variable delivery, therefore, the diffuser type pump with the lowest curve will give the best overall efficiency. On the other hand, a pump of this type would be unsatisfactory for delivering against a constant pressure such as boiler feeding, for at flows of less than 50% of maximum it would become unstable, and severe surging or water hammer would occur.

Specific Speed

A wide range of impeller designs has been developed to cover the full range of pressure and volume required from centrifugal pumps. Impeller designs are usually classified by an artifice known as the 'specific speed,' expressed by the formula:—

$$Ns = \frac{\sqrt{\text{gal. per min.}} \times \text{r.p.m.}}{H^{0.75}}$$

Where H represents head in feet.

This means that impellers of the same specific speed have similar shapes and proportions. As the overall dimensions are increased, the impeller not only passes a larger quantity but it also develops a greater head. This explains why a single impeller in a large pump can develop a high head which would require several stages of impellers in a small pump. Typical examples of each impeller designs are shown in Fig. 4 of the paper, covering a range of specific speeds from 200 to 15,000.

In general, it may be stated that impellers for high heads have low specific speeds and impellers for low heads have high specific speeds, and the fields of application of the various impeller designs over a wide range of head and quantity are shown in Fig. 5 of the paper.

The best efficiencies are usually found in the middle range of specific speeds, as with the narrow impellers of low specific speed, disc friction predominates, whereas in the axial flow or propeller designs, the hydraulic efficiency begins to decline. This is illustrated by a series of efficiency curves with four types of impeller shown in Fig. 6 of the paper.

The performance of centrifugal pumps deteriorates as the viscosity of the fluid rises, due mainly to the high velocities of flow through the impeller. Fig. 7 shows a series of efficiency and head curves for a pump handling fluids of varying viscosity, while Fig. 8 shows how this deterioration of efficiency becomes much more marked with small pumps than with large ones.

Practical Considerations

Centrifugal pumps are usually manufactured in two main types, i.e., horizontal split casing and the side mounted or overhung impeller type. The former was most common 25 years ago and provides a robust design with good support for the shaft. The latter type, however, has become more popular in recent years, particularly in the smaller sizes, as it is cheaper to construct and, if subject to corrosion or erosion, the affected parts can be replaced more cheaply. With this design generous spacing between the bearings and a stiff shaft is required to avoid impeller vibration. Although soft packings have been used most frequently in the past, mechanical seals are now becoming popular for the more arduous duties. Many special designs of centrifugal pumps have been developed for handling fluids containing solid material and fluids containing abrasive materials and those having corrosive properties. These are dealt with more fully in the paper.

Reciprocating Pumps

For most gasworks duties requiring positive displacement of the fluid and particularly those of higher viscosity and where there is a suction lift, the totally-enclosed electrically-driven reciprocating pump is likely to be the most suitable. Fig. 19 of the paper illustrates a modern duplex pump of this type with the motor and 'V' Belt drive mounted on the crank case. The final gear reduction runs in an oil bath and there is ample spacing between the glands of the pump and crank case to avoid contamination of the lubricant. The pump end is readily detachable; the valves are of the wing guided poppet type and the pistons have floating rings.

Fairly low piston speeds in the region of 50 to 70 ft. per minute are advocated as this provides a fair compromise between high capital cost and heavy wear and tear charges. Crank-driven pumps can be run with a higher mean piston speed than direct-acting pumps since, in the former, the piston accelerates under control in simple harmonic motion, while in the latter it accelerates more rapidly. Direct-acting boiler feed pumps usually operate at low piston speeds not exceeding 35 ft. per minute.

In cases where steam pumps supply process steam users, it is sometimes desirable that the exhaust should be free from oil. For such applications, graphite lubrication has been found to be effective. After a period of running a hard polished graphite film is formed on the sliding surfaces and good running is obtained.

Reciprocating pumps can satisfactorily handle fluids with a wide range of viscosity. Fig. 20 of the paper shows the results of tests carried out on the pump illustrated in Fig. 19. The upper curve shows the variation of pump efficiency when operating at full load over a wide range of fluid viscosity, the tests being carried out with 950 sec. heavy oil at different temperatures. It is evident that the general level of efficiency is high.

There is a pulsating flow from reciprocating pumps and it is common to install air vessels on the suction and delivery branches to cushion the pulsations and give steady flow in the pipelines. It is important, however, that the vessels should be checked regularly to see that they are fully charged with air. Air is soluble in most fluids and it will disappear from the vessels in course of time. On the above pump, tests with fuel oil at 150°F. showed that the air disappeared in about eight hours. It is, therefore, evident, that air vessels should be checked at regular intervals and not neglected, as is all too often the case.

Rotary Pumps

An extensive range of rotary pumps is at present marketed and there seems to be no end to new and ingenious developments. A number of pumps are illustrated in Figs. 21 to 32 of the paper and it is appreciated that there are many omissions. All pumps are of the positive displacement type and operate best on liquids with lubricating properties, and none is very suitable for handling fluids containing grit or abrasive particles. Apart from mechanical friction, the principal losses in rotary

(*Concluded on p. 732*)

Town Gas and the Changing Needs of Industry*

By R. F. HAYMAN, B.Sc., M.Inst.Gas E., F.R.I.C., M.I.Chem.E. † and
E. A. K. PATRICK, B.Sc., M.Inst.Gas E., A.R.I.C. §

SINCE 1939, there has been a profound change in the balance of costs of British industry. So far as it is possible to attribute this to one cause, this cause can be written as 'full employment,' which makes labour a seller's market; many of the changes referred to arise as a natural result of this.

The primary result is that labour becomes more expensive, and so the employer wishes to use his manpower to the best advantage, or, in topical phraseology, to increase its productivity. A secondary effect is that the rise in prices that follows the rise in wage rates affects the capital charges for new plant, and this causes the industrialist to demand maximum productivity from his plant.

Another result of full employment is to diminish the incentive to undertake training for skilled trades, giving rise to a greater willingness on the part of the employer to install complex and expensive plant in order to bring the work within the ability of semi-skilled or unskilled labour. Full employment also, by giving the employee the power to select his work, places more emphasis upon welfare activities and the provision of pleasant working conditions.

Working against this background, the industrial gas personnel of the gas industry are charged with the task of securand holding as much of the potential industrial load as possible. It is only natural that, like most other jobs, some special difficulties are met with in the prosecution of this task.

Industrial Gas Load

Sales of gas for industrial processes are increasing. The rather greater rate of increase in the last year may be attributed partly to the fact that industry is flourishing. It should, however, be stressed that, except in rare circumstances, industrial gas does not sell itself. Moreover, having been sold, the load is continually subject to searching criticism caused by competition from other fuels, the state of the market for the goods being produced, and the attitude of the management. The keener the works manager, the more difficult it will be to satisfy him, and this places a continual burden on the small force of industrial gas engineers throughout the country. This burden is lessened by the installation of appliances of sound design, and insistence on high standards cannot but help to maintain and increase the load, which, in turn, must result in larger sales of equipment.

The policy of promoting dissatisfaction in order to foster sales, beloved of and so successfully practised in some English and American markets, may be interesting with certain products, but the policy of designing equipment for early obsolescence applied to industrial gas equipment carries the risk of indifferent performance leading to high running and production costs. These factors, if they get to a stage of being troublesome to the management, may well mean a change of fuel, and, once this happens in a works having equipment of appreciable capital cost, it may mean loss of the load for at least 10 years All available efforts must be put into selling the load in the first place and subsequently retaining it by the provision of first-class service.

The industrial selling force of each gas board, backed up by the Industrial Gas Development Committee of the Gas Council, is in a powerful position to offer what no other fuel supplier can, at the moment, give, namely, continuous service. This service may not be ideal or even adequate everywhere at the moment, but the tradition of co-operation in the discussion of technical problems, which the Industrial Gas Development Committee and its predecessor have fostered for over 20 years, is unique, and one problem is that of really making the best use of it.

As stated by Dickinson and Johnson, 'The gas industry must quickly recognize that business will go to the fuel or heat supplier who, by skill, enterprise and energy, anticipates and meets the changing problems of modern industry.' These views are well known, of course, to a number of manufacturers, and those of them who have responded effectively have benefited.

Thus, the gas industry sets out to offer a comprehensive heat service to industry, seeking to assist the industrialist to obtain the fuel and equipment he requires, and to assist the industrial appliance manufacturers in the design of suitable equipment. The industry also helps itself, by the sale of gas, by protecting its reputation against the poorly designed appliance and installation, and against the uninformed user.

Service to Industry

The gas industry approaches the problem of giving the best possible service along two separate avenues. Service is offered to the industrial consumer in the selection, installation and maintenance of suitable equipment, this service extending, if necessary, to the development in one of the gas industry's industrial laboratories, of specal equipment, should conventional apparatus be unable to deal satisfactorily with the problem. Service is also offered to the industrial appliance manufacturers, who are encouraged to submit their products for examination, as a result of which recommendations for improvement are frequently offered and freely discussed. Provision of both these services has its special problems, and these will be discussed separately.

The industrial consumers' attitude toward fuel utilization is largely decided by the part that fuel cost plays in the value of the finished product. This varies very considerably between the different industries.

Where the fuel costs are a relatively high proportion of the total, emphasis is apt to be on fuel economy, but in those cases where fuel cost is a relatively small item, productivity is of paramount importance, and many industries are willing to use more fuel, or a more expensive fuel, if by doing so they gain in labour costs, floor space, or reliability, and thereby improve the overall productivity of the process. In fact, such considerations can extend well into the fields where fuel costs are high; for example, it has been found that melting furnaces for die casting are especially acceptable if their heat losses are low, because the operators are able to work better under the resulting improved conditions.

Thus a somewhat paradoxical situation can arise wherein it pays to use more fuel in order to save labour and so reduce overall cost. In such cases, the national need for fuel economy can only be reconciled with circumstances by ensuring that the most efficient heating equipment is used. Within this framework, therefore, the industrial gas engineer has to do his best to provide the heat service required by industry. His work proceeds most happily where full and frank co-operation with the consumer can be achieved.

Design for Increased Productivity

Factory floor space is at a premium, and it is always good management to operate plant to the maximum capacity. There is the inevitable demand from a works that is growing for the plant to work at more than the designed output. In the case of gas-heated equipment this frequently takes the shape of attempts to increase the temperature, thus increasing the throughput.

Attempts to increase the heat input of an appliance show

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† Industrial Gas Officer, Gas Council.
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up an inferior design more rapidly than any other method. In this problem, close co-operation between the industrial gas engineer and works management is essential if the gas-heated equipment is to be made to work harder and at the same time remain reliable. If, in a production line, gas-heated equipment or any other kind of plant is subject to breakdowns either by failure or weakness in design, the cost is often crippling. Sir Oliver Lyle said in his address to a recent Incorporated Plant Engineers' Refresher Course, that a short-term breakdown in his factory cost 3s. a second. Fitting of controls on a normally reliable appliance may make it proof against unintelligent handling, but unless the layout and design of the controls is first-class, the nuisance effect of the resultant shut-downs may change rapidly from an irritating occurrence to an impossibly expensive luxury. It is therefore of prime importance that gas-heated plant in such a responsible position should fulfil its arduous duties without any appreciable maintenance problems. The flexibility and other well-known advantages of gas are often taken for granted, and their virtues can be wasted by insufficient care in design.

Service to the Appliance Manufacturer

One of the activities that industrial gas staffs have to undertake is the endeavour to persuade industrial appliance manufacturers to improve their products. There are a great number of firms, large and small, undertaking the manufacture of industrial gas appliances—far more than those in the domestic appliance field—and many of these are not primarily fuel appliance makers at all, so that it will be understood that the standard of their products varies very widely.

The value of the relatively small number of manufacturers experienced in the provision of a heat service for industry, has been stressed many times, and it will be understood that the trials of the designer mentioned in this section relate chiefly to the firms who, as stated above, are not primarily fuel appliance makers. Many problems arise from the fact that town gas is very simple to use if efficiency is of little concern, and therefore any engineering firm feels able, having designed a piece of equipment, to clap a gas burner beneath it.

It comes about, therefore, that not infrequently it may be desirable to approach an appliance manufacturer with the suggestion that the gas industry would be delighted to examine a sample of his production and advise him, free of charge, of ways in which it might be improved. Such a request frequently evokes a willing response, and a happy collaboration ensues to the mutual benefit of both parties. Recommendations are made, firstly to ensure satisfactory combustion, secondly to promote fuel economy and reliability in service, and thirdly to simplify construction and improve the appearance of the equipment.

Tribulations of Evangelism

It must be recorded that it sometimes happens that less encouraging replies are received to offers of assistance. Most of these are, in effect, one of the following stock answers:—

(1) 'We are very willing to oblige, but unfortunately our manufacturing capacity is fully occupied in satisfying the enormous demand for our products.'

Or—in other words—'we are too busy selling (at a profit) a product which may be unsatisfactory, or even dangerous, to spare one for test.'

This attitude is of course, a short-sighted one, and it is difficult to believe that any but the smallest firms are really unable to lock up part of their capital in an appliance that would be under test for a few weeks before being sold.

(2) 'We would very much like all our equipment to have governors (thermostats, or other desirable features), but unfortunately, our customers will not pay the extra cost.'

This is undeniably true in some parts of the industrial gas appliance market as it exists, but one cannot help observing that many industrialists who complain bitterly at a few pounds spent on proper controls for a gas appliance will spare no expense when it comes to the provision of machine tools. It is to be noted that the makers of complex, up-to-the-minute equipment, such as modern spectographs, radiographic equipment, precision tools, etc., usually offer for sale a product complete with all refinements for a fixed sum. Portions that are essential for safe and satisfactory operation are not offered as extras.

There would seem to be scope, therefore, for a firmer and more confident approach to the purchaser, modelled on that adopted by other industries, saying, in effect, that good work and contented staff come from good plant, and, moreover, that fuel of any kind is today an expensive commodity requiring precision tools for its use. There are some firms today that do adopt this policy for the sale of industrial gas appliances, and they are not any the worse for it!

(3) 'We have invested large sums of money in tools, and cannot therefore consider any modifications.'

Press tools, etc., are admittedly very expensive, but those who invest capital in them do so in the expectation of reducing the overall production cost, hoping ultimately for increased profit from increased profit margin or increased turnover. Surely, therefore, the onus is on them to ensure that their product will be satisfactory before having the tools made, and if, for reasons of expediency, they take a chance and tool up before finding that the design needs some modification, then they take a risk, and cannot complain if they do not always get away with it.

(4) 'We would like to adopt your suggestions, but our customers have known this appliance for years and will not tolerate any alterations.'

This attitude deserves some sympathy, but tact and determination will show a way to overcome the problem. Many examples exist where traditional products have been modernized stage by stage so that today a thoroughly up-to-date version is sold without any violent break having been made with the tradition behind the product.

(5) 'The industrialist is not interested in appearance.'

This was once put more trenchantly as: 'Chromium plating cuts no grass in basements'! There are undoubtedly many industrialists of whom this is true, but there are very many people, both employers and employees, of whom it is not. It deserves to be remembered that even the man who cares nothing for appearances inevitably has visitors to his plant, who may be more sensitive, and may even unconsciously register a bad impression. Pleasant-looking equipment invites care, and will promote a contented staff.

There are two more answers, which are fundamentally more difficult to cope with, but are by no means unknown. They are:

(6) 'We have been designing this type of plant for many years, and our product is the best on the market, we have thousands of perfectly contented customers, and we are not aware of any need for modifications.'

This type of answer is liable to come in response to a complaint of upwards of 1% of carbon monoxide in the flue gases!

Finally, as a limiting case, we have

(7) No answer at all to our overtures.

Future Steps

There are several obvious developments to be considered so that industrial appliances shall be as mechanically and thermally efficient as possible.

Simplicity

Equipment must, in general, be designed to be simple. There is some opposition in the gas industry to simplification of design and elimination of multi-burners, on the ground that a single unit can be replaced by oil more easily than a complicated or multi-unit, and that, therefore, the chances of losing a load to a competitive fuel are greater. In the authors' opinion, this attitude is wrong. The chief problems in competition from other fuels are economic, and if a load is retained on the uneasy basis that the equipment is difficult to convert then the loss of load is only deferred and estimates of future loads will be based on false assumptions.

There is a vast field for progress and increasing loads, which has yet to be tapped, and these will only be obtained if the equipment available compares favourably in performance and appearance with the best. It must be remembered, also, that there is a growing insistence on the complete protection of some plants against flame and ignition failure. Where possible, the use of a single flame simplifies this

(*Concluded on p. 732*)

Some Trends and Influences on the Domestic Load*

By A. V. Horsfall, Assoc.M.Inst.Gas E.†

THE problem of lessening gas consumption in the domestic field is a matter giving concern throughout the industry. In this paper, an attempt is made to analyse some of the reasons contributing to the present position and to evaluate the causes, the more clearly to see in what part the losses may be considered permanent or temporary. Quite obviously losses in domestic lighting brought about by the clearance of slum property will not be recovered by increased gas lighting in new houses, therefore this loss is permanent; but where reduction in use for domestic purposes arises from economic reasons, changing conditions brought about by full employment, alterations in the habits of people, competition from other fuels and replacement of obsolete appliances, then such losses may in part be of a more temporary nature.

Practical Aspects

If the causes which are suggested as giving rise to the effects are accepted, then action can be taken to provide a remedy. I would like to make it clear that in suggesting possible remedies, particularly by way of appliance development, it is realized that such development must have a practical aspect and will need much further consideration than is given in the paper. The purpose of the paper is to suggest some channels which upon further investigation might lead to increased sales of gas with appliances of improved functional performance.

There must be few industries which over the years have so constantly and purposely striven to provide an improved service for the benefit of the public by way of modern appliances, well knowing that in so doing the new appliance may result in less gas being used when compared with the replaced appliance. In effect, over the years, this development has reduced the cost of carrying out many domestic functions, and without the technical improvements so made, the amount of gas used and the consequent cost to the consumer would be appreciably higher.

Since this aspect of lessening domestic gas sales is within our own control, it might be thought that we have arrived at the cross roads, where some halt should be called to improving efficiencies in order to concentrate more on sales with appliances which do not further reduce consumptions. The view is expressed that to adopt such a policy would be quite wrong, especially at the present time when external influences beyond our control make increases in the price of gas unavoidable.

On the question of electrical competition it must be expected that as more electrical power becomes available, competition in all spheres including the domestic market will intensify. For a long time it has been apparent that our competitors are concentrating on the domestic cooking load, but the sales of electrical appliances for space heating, water heating and home laundry far exceed those sold for cooking and it is in these domestic fields that electrical progress is being made.

Promotional Tariffs

It is therefore in the section of the public dealing with the load building value of appliances that the proposal is made for consideration to be given now to the question of promotional tariffs for gas space and water heating, bearing in mind that with the implementation of the Beaver Committee Report and the commercial security available to our industry by the increased sale of coke, a realistic, economic balance between commodity charges will possibly be maintained only if the enormously increased quantity of gas which also becomes available by additional carbonization is also sold.

It is not without unjustified hope that we may look towards the coke market of the future to provide the means by which, in spite of rising prices of essential raw materials and other factors over which we have no control, we shall be able to offer reduced gas prices. The implementation of promotional tariffs in more than one aspect of domestic utilization may widen the field for future manœuvres when and if price reduction becomes a possibility.

The implementation of the Beaver Committee Report should give the industry excellent opportunities to increase gas sales, and at the same time where mains are available, encourage the installation of gas supplies in all new houses constructed. Quite obviously, if a gas service is to be laid to a house merely to provide means of easy ignition to one or two solid smokeless fuel fires per house, then the full cost of such work must be recovered. On the other hand, however, where potential gas usage is increased by the provision of points for additional normal domestic utilization and full freedom of choice given to householders, then no doubt area gas boards will continue their present policies in regard to main and service installation costs, and electricity area boards may no longer be able to dictate terms subject to the exclusion of gas supplies.

In the course of time, the full effect of the Beaver Committee Report transferring carbonizing quality coals now wastefully used in domestic and industrial markets to the carbonizing industry may have some result in assisting towards the reduction of organic sulphur in town gas. There is no doubt that much of the inferior coal which the gas industry is compelled to use at the present time is the cause of increasing awareness by public and producer alike to high sulphur content gas.

On the question of sulphur removal, we all, without doubt, would like to distribute less than 10 grains per 100 cu.ft. sulphur content gas. Unfortunately, there is little data available on which to establish an accurate assessment of the saving in cost of appliance servicing or the increase in sales of gas likely to arise with low sulphur content gas. It is suggested, however, that useful information on the question of appliance servicing frequency over a wide field of utilization and on a mass scale could be ascertained from American and Continental sources using gas of low or negligible sulphur content.

It is important, however, to bear in mind that sulphur removal in itself will not automaticaly bring increased sales, but it will provide opportunities to extend the use of gas for flueless space heating in areas where today the distribution of gas in excess of 25 grains makes the development of this load impracticable.

It is contended, however, that irrespective of gas purity and bearing in mind the cost of other fuels used in the domestic market, the real difficulty to be overcome is that of commodity price and if the industry is continually called upon to bear excessive increases in the charges for its basic raw material, we shall find it increasingly more difficult to develop the space and water heating loads.

The removal of organic sulphur to less than 10 grains per 100 cu.ft. will allow the cheaper construction of water heaters manufactured from materials which would not need to offer high resistance to corrosion, and furthermore since internal flueway apertures would not be subjected to accumulated deposits, the way should be opened for major redesign of appliances of improved heat transfer and higher efficiency.

Load-building Value of Appliances

Strenuous efforts must continue to be made to increase the sale of all domestic gas appliances if the industry's position in the domsetic field is to be consolidated and improved against increasing competition by other fuels. Equally obviously, there are some appliances that, in use, contribute more than others to increase the gas load from existing gas consumers. This particularly applies to refrigerators, gas-ignited coke grates, space heaters and, in some circumstances, to water heaters and laundry appliances installed as additional equipment. Where new cookers replace old ones, consumptions may decrease, and this reduction would also appear to apply in some instances where washing machines replace wash boilers and sink water heaters are installed.

In a random survey of consumer accounts where it was known that new appliances had been installed, total consump-

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† Sales and Service Manager, West Midlands Gas Board.

tions were compared for the years before and after appliance installation. Many accounts were compared and had to be eliminated because of changed circumstances such as increase or decrease in number of household, illness, gas replacing electricity, and numerous other causes. Of the number remaining, while small in total, these represented cases where, so far as it has been possible to ascertain, household circumstances and conditions have not altered.

A Material Increase

As is to be expected where single-point (not sink) and multi-point water heaters, refrigerators, space heaters, wash boilers and coke fires are installed, gas usage has shown a material increase. With cookers and washing machines fixed in replacement and sink water heaters additionally installed, consumption may either increase or decrease quite considerably. The reason for decrease where new cookers replace old models and usage continues unchanged is probably attributable to increased appliance efficiency. One fact that does emerge, however, is that, in all cases examined, where the replacement cooker is fitted with a pilot providing automatic ignition, consumption increased and consumers themselves were not very concerned because they thought the extra cost worth the convenience.

With sink water heaters, the reason for lower consumptions appear to be that whereas previously the small quantities of hot water required for general housework had been heated on the cooker hot-plate, this load is now transferred to the much more efficient sink water heater, and only the actual quantity of hot water required is drawn off. There is some evidence to indicate that for a period immediately following installation, the sink heater is used sparingly. It is probable that customers are inclined towards sparing use because they feel the cost may be high, but as time progresses and they find their gas bill no higher, or even less than before the heater was installed, then the machine is brought into greater use. Subsequent comparison of accounts, quarter by quarter, shows that this suspicion of higher cost is lessened, and the earlier losses tend to become less apparent. It may well be that in many cases of lowered consumption, the sink heater will eventually bring about an increase in gas used.

Washing Machines

Regarding washing machines, the majority of the large number of electric machines sold each year have no provision for boiling water, and rely on mechanical agitation of hot water and detergents to provide results. As more and more electrical machines have come into use, the public have been educated towards accepting mechanical agitation as the adequate means to satisfactory washing. The result is that where a gas washing machine with mechanical agitation and provision for water boiling is installed to replace a gas wash boiler, less gas is consumed, particularly during winter months, because hot water is drawn from the back boiler or independent boiler supply, and boiling is used only for about one in each three washes, whereas it was previously used for each wash. At other times, reliance is placed entirely on mechanical agitation, with very good results indeed—so much so that, where boiling is occasionally used, it is rather more with the object of sterilizing than obtaining a cleaner wash.

It is noticeable, however, that, with the intense competition between detergent manufacturers, added emphasis in matters of publicity is being placed upon boiling. It is now being said that 'So and So's' detergent 'boils whitest', rather than 'gives the whitest wash'. It could be that further development in the continued and increased use of gas for clothes boiling with washing machines might be achieved by closer co-operation between detergent manufacturers and the gas industry in matters of publicity and general customer information.

These comments may, with justification, be considered somewhat negative and of little assistance to building up the domestic load. Perhaps because of the very small field covered by the customer survey, a positive lead is indicated that a larger survey would merely confirm. This concerns those appliances the use of which indicates, and in fact is generally accepted as providing, the most valuable contribution to increasing the load. These appliances are refrigerators, solid-smokeless-fuel fires with gas ignition, storage and multi-point water heaters providing a whole-house hot water service, and space heaters.

With the first two types of appliance, hire purchase facilities and reasonable running costs are already sufficiently attractive to suppose that the public will continue to have them installed in increasing number. Indeed, the implementation of the Beaver Report may provide the impetus for a considerable increase in the use of gas for the ignition of solid fuel. The average gas-ignited solid smokeless-fuel fire brings an additional consumption of about 10 therms per annum, and it has been estimated, by the Beaver Committee, that, in order fully to establish smokeless zones, about 7 mill. houses would need the new grates. If only 50% of these new grates are fitted with gas ignition, this can mean an increased demand for gas of up to 4 mill. therms per annum.

Additional demand for gas should also arise from existing premises fitted with improved open fires without gas ignition, many of which may at present be burning bituminous fuels. Under smokeless zone conditions, these fires will be required to operate on smokeless fuels. Where coal was used, it could be ignited by the wood-and-paper method; with smokeless fuels, however, a more convenient and easy method of lighting will be by the gas poker, and the bar type of poker should find a ready sale.

The ideal, from the point of view of the gas industry and national fuel conservation, is that all sections of the community should look to gas for the two essential services of water heating and space heating, but as an industry we may use every form of persuasion and still achieve only minor successs, unless we offer a service, the running cost of which is cheaper than any other alternative.

Future Development of Appliances

If it is accepted that because of full employment and consequent changing habits concerning home cooking, consumers are not using their cookers to the same extent as previously, it is not unreasonable to feel that the trend might be corrected by (i) providing means by which cooked meals could be made available even more quickly; and (ii) fitting automatic controls to turn on and light oven burners at predetermined times before consumers return home. The principal advantage of gas cooking over its competitors is the speed by which hotplate and oven burners can be put into effective operation. Speed must continue to be the essential factor in favour of gas. Apart from normal hotplate and oven use, there remains only one other method of cooking which can claim quicker results. This is the pressure-cooking vessel, and here again gas has the advantage because it provides the most convenient and rapid means by which heat can be applied to the vessel. Is there, then, a case for developing a gas cooker with a pressure-cooking vessel as an integral part of the hotplate design?

Apart from ignition and cooking quality, the most important requirement by consumers is cleanliness and the ability of the appliance to remain free from surface enamel staining and fouling of wall decorations. With the object of cleanliness and for the benefit of both consumers and the industry, the future design of cookers should consider adopting as standard requirements, the following features: (1) Front-flue oven outlets. (2) high-level grill burners. (3) detachable oven linings, including oven top lining. (4) embossed over shelf supports, rather than wire or sheet metal gates, and (5) better means for the collection and easy disposal of spillage on hotplates.

Regarding the construction and appearance of gas fires, the modern fire still bears a remarkable resemblance to that of 20 years ago. Progress in design has not been so marked as with other appliances, and some opinion may hold that convector fire design is retrograde in appearance. Most of the business for convector heaters has in recent years been captured by the paraffin-burning appliance, which is free of purchase tax, economical in running cost, comparatively odourless burning modern refined fuels provided the well-aerated 'blue-flame' burner is maintained in clean condition, requires no installation cost and is portable. As an indication of the sales of paraffin convector heaters, one supplier manufacturing both gas and oil heaters sells 30 oil heaters to each gas heater.

The present sales of sink water heaters throughout the country are nearly 400,000 per annum, and the tendency today seems to be to fit these heaters rather than to press for the installation of the larger type of appliance that provides a hot water service throughout the house. This probably arises from consideration of installation expense, but the very fact that sink water heater installation predominates, brings with it the

(*Concluded on p. 731*)

The Architect and Industry*

By E. D. Jefferiss Mathews, O.B.E., F.R.I.B.A., A.R.I.C.S.†

WHAT is the new approach which the architect should have towards industry, and why should it result in things different from those we have known in the past—in general, those we have accepted until now? I base a great deal on this statement: 'Architecture is the only art that is wholly related to economics.' A painter may create a masterpiece; in his lifetime or after, it may change hands at fabulous sums, but its pure economic value remains at the mere cost of a few square feet of canvas, wood frame and a little paint—the same in fact of any painting irrespective of the master, the same for an indifferent painter as for one of great skill. It is the same in the art of music, the art of literature, of sculpture and of drama (although in this I accept that, when related to the commercial theatre, there is an indirect relationship to economics). The medium of expression has in itself no economic value. But in architecture this, obviously, is not so. Whether it be chicken-house or cathedral, bungalow or mansion, a gasworks gatehouse or the whole great building which may be necessary to enclose the production machinery of the plant, the costs of the buildings are directly related to the economy of the industry, in fact to the national economy, and it is the buildings no less than what they enclose, nor no less than their purpose, which are architecture.

The practice of architecture today poses a trinity, inseparable and co-equal, at one and the same time; in all respects it is an art, a science, and the function of administrative organization; certainly a formidable combination of differing characteristics which imposes on us the challenge which most of us like to accept, and which is the zest, and quite honestly the fun, of our job.

It is by no means uncommon for me to be asked by my industrial clients (whom I have not yet 'educated'), whether such and such a requirement of theirs would 'upset my architecture.' If it is indisputably a requirement of engineering, of science or of economics, that such and such should be, then most assuredly it should be. As engineers, you have rightly dictated that requirement. It is the challenge to us to accept it and, without affecting its efficiency or without detriment to it economically, to produce, nevertheless, good architecture. If we on our side forced that requirement to change, because by so doing we thought that we could obtain better 'architecture,' most certainly, whatever the superficial appearance of the result, it would not be better 'architecture,' because it would in all probability either have reduced efficiency or increased costs. Equally, if you on your side had forced the point without careful re-examination, study, or really forward and progressive thinking, you might have caused unnecessary ugliness, if not reduced efficiency and perhaps even unnecessary costs. It is at this stage where our mutual interests can either be co-operative to the benefit of the ultimate result, or antagonistic to the detriment of the result. Like any partnership, from commercial to marriage, nothing really effective can be written as the basis for the establishment of that partnership which will solve the problems or differences which must inevitably and in fact rightly arise. Solution and efficient results depend upon the mutual understanding of the interests of one for those of the other. We as architects have to appreciate the points, the interests and outlook of you as industrialists and engineers, whether it be in your particular field of gas engineering or any other industrial enterprise. You, in your turn, have to appreciate our outlook, our interests and our proper and correct function.

It is a constant surprise to me that you who have achieved, and continue to achieve, such advancement in the technological development of plant, equipment and production methods have failed to demand equal advancement in the technology of building. Why is it that up and down the country we see today new and massive buildings conceived and constructed in ways which have not changed in the last 30 or more years —to say nothing of the fact that it is often difficult to determine whether one is looking at a power house or a cathedral —which are housing, surrounding, or in some way related to, the most up-to-date and splendid technically advanced engineering equipment? Why is it that so many otherwise most highly informed and progressively-minded people are apparently oblivious to the fact that the technology of building has changed and advanced just as much over this period of years as has been the advancement in your field? It has been a particular study of mine to attempt to find the right answer to these questions, because if they are not answered, and if the answer is not known to those who are in a position to influence the design of buildings, and today this is a very wide public in all walks of life, we may never make the advancements of which the building industry is capable. I believe that the answer lies in a fault on both sides. There is no doubt that a large number of my profession have failed to recognize or accept the changes, nor have they made the efforts necessary to develop the changes, since it is always easier and safer to do what has been well tried and accepted than to go into fresh fields. But some share of the lack of progress must also rest upon the industrialist, and, to speak plainly, I feel that it is the engineering side of industry who must carry the greater responsibility for industry's failure to encourage us to make the changes and to progress. But even part of this failure on your part must be shared by us, as we have been lax in bringing before you this economic and progressive development of architecture.

I have by chance come across in your own industry an example which might well have been the 'text' for this paper. It has fascinated me, and I am grateful to your President for having been permitted to take photographs of old meter equipment at Portsmouth. It is wonderful, the most perfect reproduction in miniature of a Greek temple, architecturally accurate in proportion and detail, and all in cast iron! I do not know exactly what actually happens inside, nor the method of metering which this edifice houses, but I am quite sure that it bears little or no similarity to what happened inside a Greek temple—unless it was that in their temples the Greeks did as much 'gassing' as sometimes happens in our own time in buildings designed for the assembly of people! At the time this thing was designed your predecessors and perhaps mine were evidently so embarrassed by the nakedness of what was merely the functional requirement that they hastened to hide their blushes behind the ever resourceful curtain of the cast iron manufacturer.

A coal washery house designed by H. V. Lobb is a good example of a logical way of cladding an industrial plant. First and foremost, I suggest that it has the character of honesty, and from this, I think, must follow that it is economical, efficient for the purpose for which it is intended, simple in construction and most readily adaptable to any change of the plant requirement or addition. But in achieving these characteristics it loses nothing architecturally, because these are the architectural characteristics which the purpose demands. In proportion, colour, texture, and in the whole composition it is æsthetically correct. It is good architecture.

'Dry cladding' is the logical outcome of the principle of the framed structure, yet it has taken nearly half a century to develop! For years after the framed structure was evolved, we were continuing to 'clad' it with walls which were strong enough to have carried the structural load, although in fact this was being carried by the frame. Gradually, these walls became lighter, but even today the orthodox brick or comparable 'wet' construction material is in common use as panels between the frames, imposing heavier loads than need be on the structure and maintaining all the disadvantages of 'wet' construction and 'solid' walls. The first sensible approach to lighter cladding evolved from what has commonly become known as the 'cheap' industrial building—a framework clad with some form of corrugated sheeting. But this was of a standard too low for consideration in all but the most

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minor cases or for the rather specialized use for certain types of heavy industry production buildings. The logical development really started in the early 1930s when such buildings as the *Daily Express* offices in Fleet Street used glass, both opaque and clear, in light metal framing as a cladding to the heavier structural framing behind.

The Structural Form

Parallel with the development of cladding has been the development of the structural form itself. We have seen that a lightweight cladding is the logical outcome of the principle of framed structures as opposed to structures whose loads are conveyed to the stability of the ground by means of walls. But few of us are satisfied that the orthodox principle of beam and post is the ultimate outcome of the structural materials available to us. At its best, this principle has limitations of span in relation to economics, and of the drawbacks of the separation between the structural and the cladding elements; each performs a separate function although it might be integrated to form a combined function. I, for one, shall not be satisfied until a unification—a relationship at least—between these elements has been achieved, as it would seem that in separation there must arise cost factors which are not wholly economic.

We have yet to come to that combination of the two components which the mediæval designers achieved. In the period between the last two wars there was again a flash of progress, perhaps rather more than a flash, since it revived in us the need to press on and find the logical progressive development which awaited us. We found that with reinforced concrete we could do more than just a frame. By changing the shape, we could turn a beam, normally squarish in shape, into a wall as well by making it deeper and thinner. Here was something really worthy of note, something very akin to the mediæval masons. On the face of it, it offered all we were striving for. It was a plastic material which could be moulded into the shapes we required. It was both wall and frame.

Why, then, has it proved not to be the answer? Before I give my answer to this question, I must make a qualification because I have reached, in this briefest of structural surveys, contemporary times where views tend to be personal. There will be some of my contemporaries who will say that it is the answer. But for my part, I say that it is not, because it presents certain aspects which are the reverse of the direction in which it would seem logical for us to go. It is a 'wet' structural method involving complicated and laborious site works in shuttering and so forth. I have been stressing the essential relationship between architecture and economics. Today, with the high wages of the building industry, the risk of weather delays being imposed upon the employer instead of the employee, as used to be the case, all the high costs and imponderables which might lead to high costs arise from site works. I argue, therefore, that it cannot be a right development to rely upon a method of construction which, by its nature, involves just those things which are, or are liable to be, elements of high cost.

I arrive back at the development which I was describing with the development of the dry, thin, lightweight, cladding material. As the situation stands today, we have the principle of the frame (usually steel and often composed of small lightweight members making up lattices, both as beams and stanchions) clad with dry, factory-made panels needing only the simple operation of securing to the frame to complete the building, whether such building be a factory, a school or hospital, an office block, or an enclosure of large industrial plant.

The characteristic is that virtually the whole structure should be of 'dry' form, that as much of it as possible should be prefabricated under the ideal conditions offered in a factory, free from the imponderables of weather and labour on the site, and that, by the nature of these aspects, the building lends itself easily to change to meet the inevitable and perhaps rapid changes of what is going on inside, and by so doing, and this is an important economic aspect, provides a salvage value which would not exist in any 'wet' form of construction. But the last thing that we must do is to sit back under this situation and say: 'Goodness, it has been a sweat to reach this, but we can now repeat it for the rest of our working life!'

As architects, we fail if we do sit back. I hope I have shown that we have as much a tradition of progress as you, as engineers, have. You are not satisfied that the piece of plant which you designed yesterday will be suitable for repetition the next time you need the same thing. There is certainly no reason why we should. Because I feel that you, as engineers of a great public industry, have within your hands more chance of influencing the development of architecture than in these days have many others, and because I know that without encouragement from you, and the likes of you in other industries, we can so easily fall back into an attitude of complacency, I am hoping in this paper to show that we, like the bashful suitor, need only the slightest encouragement from the one we court, the merest flutter of the eye-lids, to be able to produce in the most gallant manner the bouquet which we are holding behind our backs.

'Transitional Stage'

It has been said that 'Good architecture needs an enlightened client.' This is very true. Examples of good architecture arose from a period when the patrons were few, but were knowledgeable, so knowledgeable that it was difficult to differentiate between patron, designer, and craftsman, in their contribution to the results. An inevitable trend in social 'development' has been the birth of the specialist with all the dangers which specialization produces. We cannot 'put the clock back'—we would not, in fact, want to—but we must take what steps we can to broaden the base of general enlightenment, or, if you prefer, of general education, so that, on the one hand, we have the specialists, each with some overall knowledge of the other, and, on the other hand, the general public, each one of whom might now at any time be a patron of architecture, with some knowledge, or at least an open mind, on the principles of the arts and the sciences. I think that the aspects which I have deprecated in relation to contemporary design arise solely from the transitional stage of education which we are now passing through. It seems to me, therefore, that the development of a proper economic architecture of the future rests in large part on the influence which specialists like yourselves can bring to bear upon buildings. In your field, you have the knowledge and the tradition; more, you have the achievement, of progress. It may be that in your working life you will come into contact only with one or two architects, and so I am back where I started on the title of this paper, 'The Architect and Industry.' The personal rather than the collective is the surest way to great achievement, an achievement of the closest relationship between the engineer and the architect, and it is from gentlemen like you that this can come.

ACCELERATED CARBONIZATION—from p. 688.

The coke produced from the carbonization of coal blends employing high rank number coals is very reactive and attains a high rate of radiation, as will be seen from the fire tests. The period between recharging the grate was very short due to the reactivity of the fuel and the fact that the test was carried out under standard conditions. The combustion efficiency on the 'Fulham' grate was low, but it should be noted that the efficiency during the second period after refuelling compares favourably with the standard coke. The coke produced in Test 3 (referred to in the paper) was of sufficient reactivity to enable the fire to be allowed to almost extinguish itself and yet recover quickly on recharge. This is of particular significance in the light of requirements for smokeless fuels as recommended in the Beaver Report.

With the backing of the 'Rochdale' process the North Western Board has, in the past 12 months, intensified its efforts on the development of the industrial and commercial load and is presently connecting no less than 12 mill. therms per annum of additional load to its system, and continuing to accept new load at an average rate of some 1 mill. therms per annum each month, at prices which, on the basis of this process, are attractive to the industrialist and show a margin to the Board. We have in negotiation further loads amounting in total to some 25 mill. cu. ft. per day for specialized industrial requirements. If the Board had to meet this load by building new works on new sites, then we could not touch it competitively, but, if we can achieve a major part of it by increased productivity from our existing plants and labour, then it may be that we have found a solution to the many amber and red lights flashing in the industry today.

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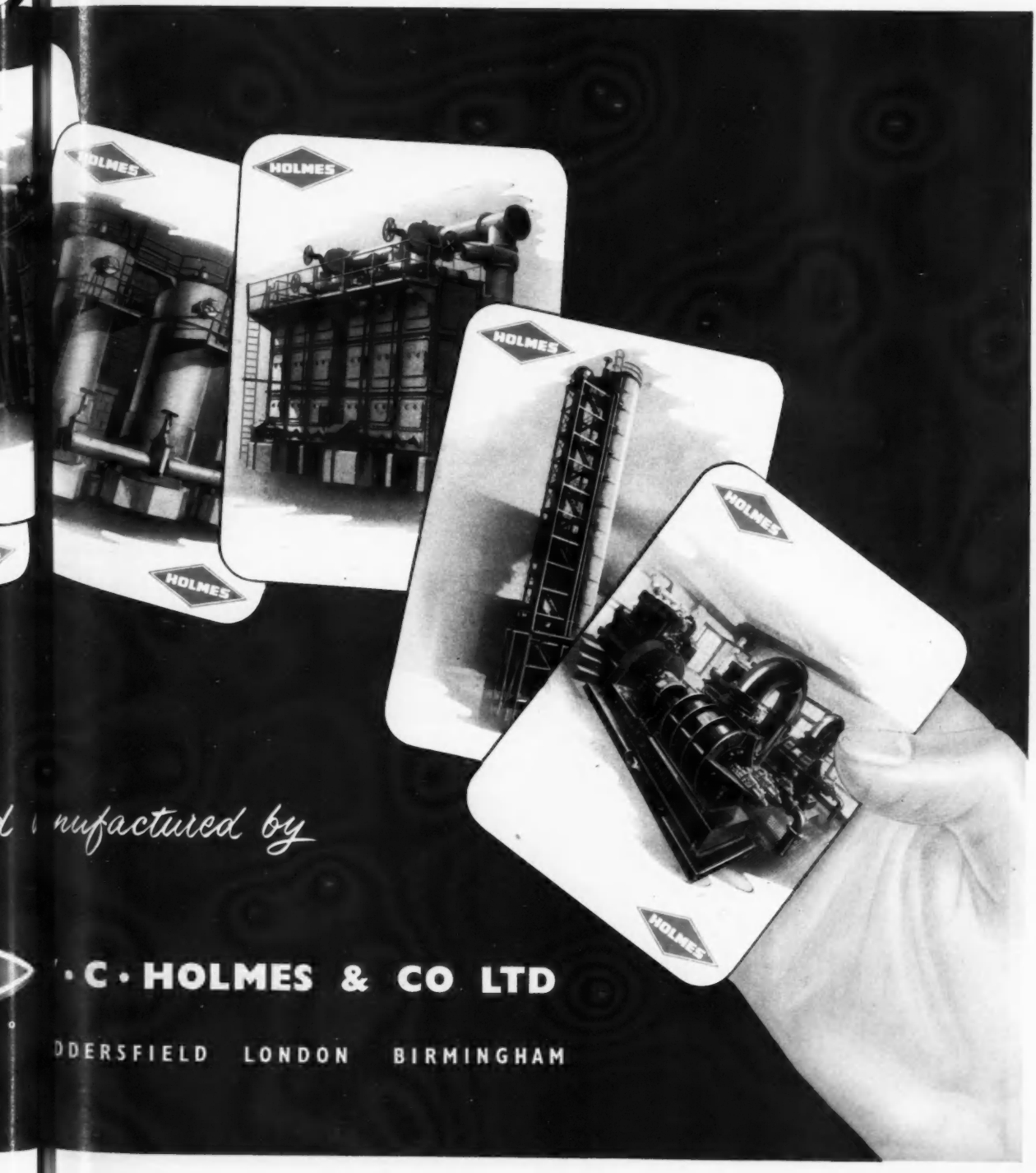

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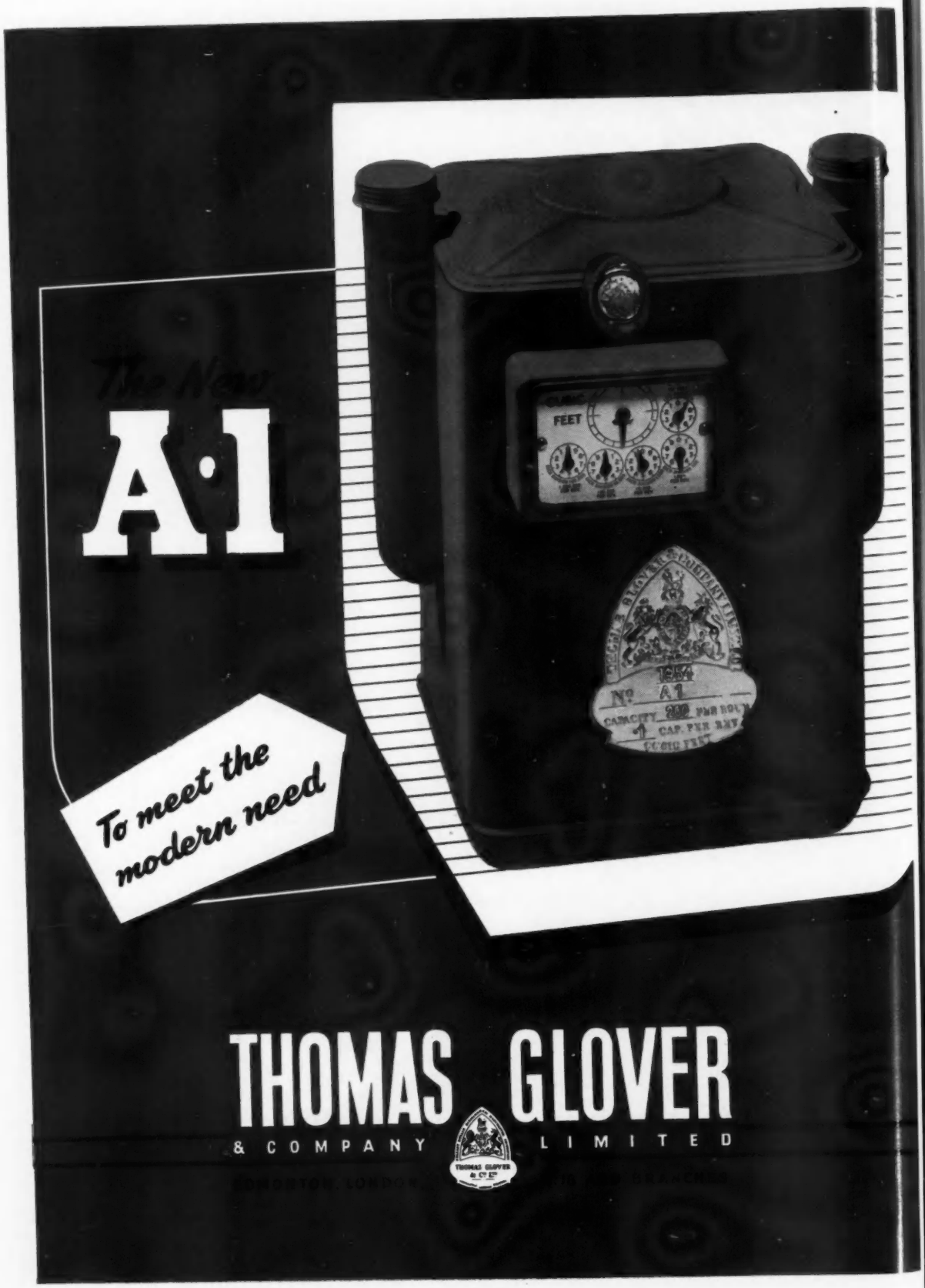
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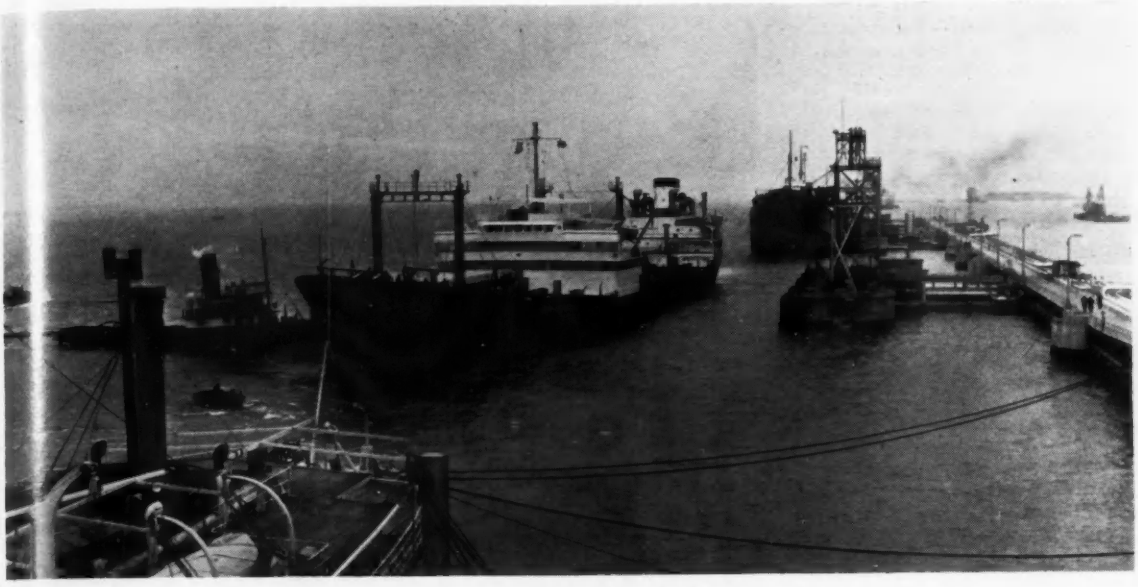


The marine terminal—one of the longest oil docks in the world.

Fawley Refinery

We describe briefly the Esso Petroleum Company's gigantic oil refinery near Southampton.

THE refinery at Fawley is the largest oil refinery operating in the United Kingdom and is currently producing well over 6,500,000 tons of refined petroleum products annually, representing about 25% of Britain's present total oil refining capacity. It is owned and operated by Esso Petroleum Co., Ltd.

Site clearance began in July, 1949, and two years later the refinery was already in operation, having cost £37,500,000 to construct. It has a throughput of 6,500,000 tons of crude oil a year, its products including 1,500,000 gal. of motor spirit every day. During the first three full years of operation the following principal products were obtained:

	1952	1953	1954
Petrol	1,733,000	1,816,000	1,832,000
Kerosine, jet fuel and white spirit..	360,000	353,000	628,000
Gas and diesel oils, fuel oils, lubricating oils and bitumen.. ..	3,754,000	3,498,000	3,903,000

Of the refined products some 82% were distributed within the United Kingdom. Taken together with a certain quantity of specialized products, which were imported, this represents about 30% of Britain's present total oil consumption. The principal countries from which crude oil imports have been obtained are Kuwait, Iraq and Qatar.

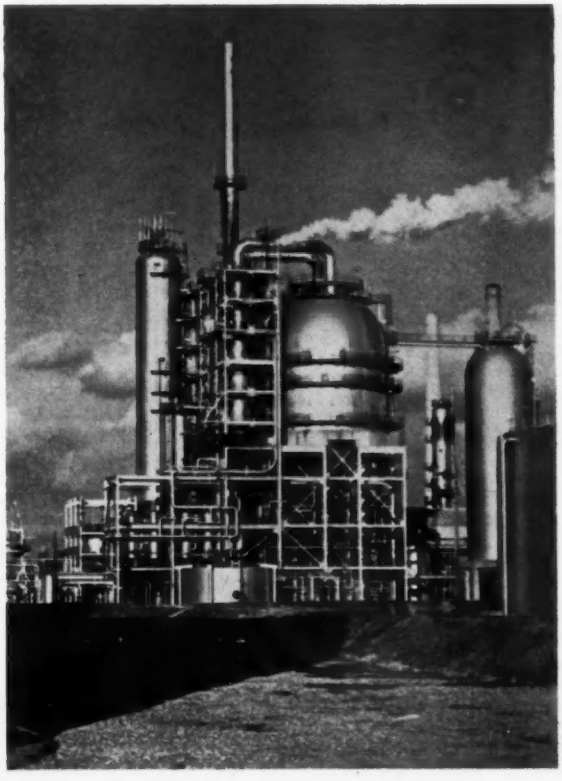
In 1954, approximately 1,160,000 tons of finished products, or 18% of the total output, were exported.

B.E.A. Saves Coal

In the same year, it was announced that the British Electricity Authority's new 300,000 kilowatt power station, now under construction at Marchwood, six miles from Fawley, was to be equipped for dual firing on oil or coal. This announcement was the direct outcome of an agreement between Esso Petroleum Co., Ltd., and the B.E.A. for an estimated quantity of some 350,000 tons of fuel oil annually to be supplied to the new station direct from the Esso refinery.

An interesting feature of this agreement is that, because of the proximity of Fawley to Marchwood, it will be possible to supply all the oil needs of the new station at a price which will result in the operating costs being no higher than those of equivalent coal requirements. Ultimately the annual rate of oil consumption at Marchwood could reach a figure of nearly 600,000 tons, equivalent to an annual saving of approximately 1 mill. tons of coal.

Considerable attention has been focussed on the fluid cata-

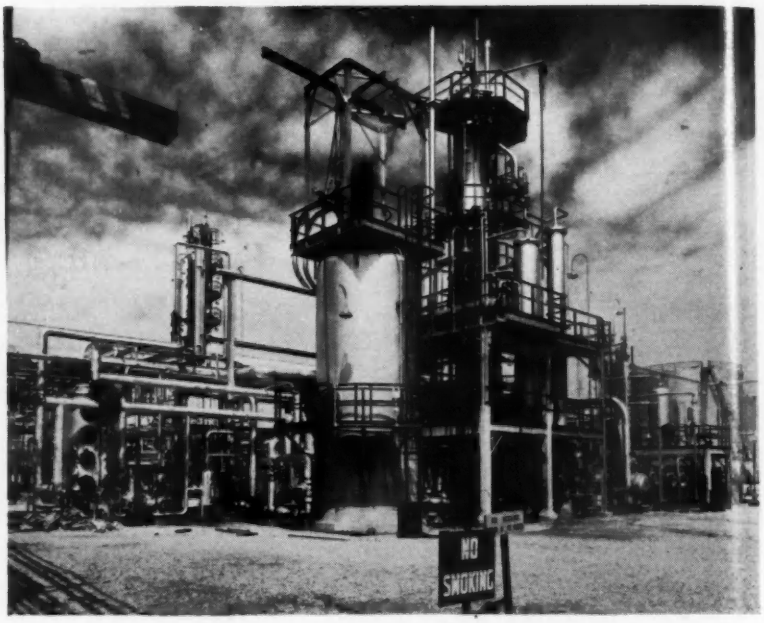


The fluid catalytic cracking plant.

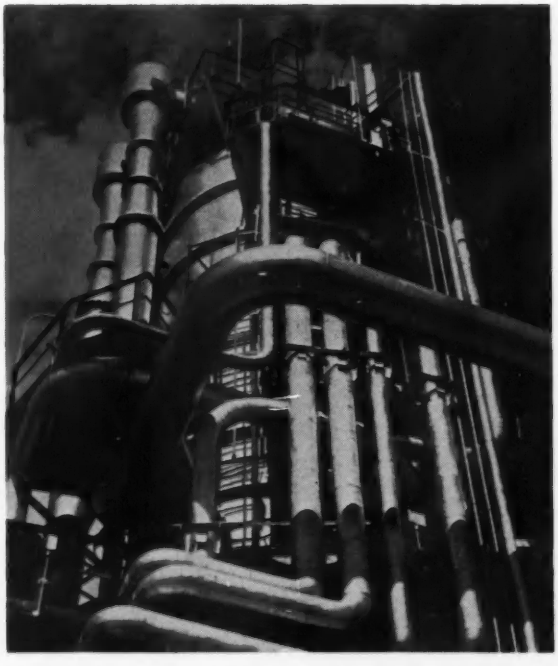
lytic cracking plants—'cat crackers'—at Britain's new refineries, particularly since the return of premium grade petrol to the market in February, 1953. These 'cat crackers' represent the primary source of this high grade petrol, the largest single source in the country being the plant at Fawley.

As an example of industrial productivity, it may be noted that the Fawley 'cat cracker,' which is automatically controlled, produces over 500,000 gal. of high quality petrol every day—with an operating crew of only nine men. Completed in September, 1951, it was the first unit of its type to go into production in Britain, and during 1954 produced well over 170 mill. gal.

The 3,200 ft. long jetty of the marine terminal is one of the longest oil docks in the world, having four breasting islands capable of berthing simultaneously four tankers of up to 40,000 tons even at low tide. During 1954, 867 ocean-going tankers were handled at the jetty, of which 344 were importing crude oil. The average figure for all types of vessels handled at the jetty is 280 a month, while incoming and outgoing cargoes average 8 mill. gal. a day. Of products leaving the refinery, over 95% go out from the marine terminal.



Hydro-desulphurizing plant. A characteristic of Middle East crude oil, on which the refinery largely runs, is a high sulphur content.



The clay contacting unit of the lubricating oil plant. This unit improves the colour and imparts a green fluorescence to the finished product.

New Plant Units and Facilities

Since the refinery's official opening in September, 1951, a number of important new units and additional facilities have been completed or are under construction. Here are some details. The primary purpose of a polymerization plant, completed in October, 1952, is to increase still further the yield of high quality petrol, the chief source of which is the fluid catalytic cracking unit. Incidentally, the process absorbs many of the waste gases previously burnt at the flare stack, thereby diminishing the size of safety flare.

A hydro-desulphurizing plant completed in April, 1953, removes from certain products the sulphur which is present in considerable quantities in the Middle East crude oil on which the refinery largely runs. Hydrogen is passed through the product, and produces hydrogen sulphide, which is then fed to the sulphur recovery plant for conversion to pure sulphur. The sulphur recovery plant itself was completed in June, 1953, having been specially installed at the request of the Government to provide an indigenous source of sulphur. Predominantly a dollar commodity, it has at times been in acutely short supply, as the gas industry well knows. Utilizing the high sulphur content of Middle East crude oil, this plant is producing 99.9% pure rock sulphur at the rate of 14,000 tons yearly, the output being entirely taken up by the British textile industry.

In September, 1953, the lubricating oils plant was completed. With the exception of a small quantity of specialized lubricants, all demands for lubricating oils hitherto purchased for dollars, will eventually be met by its production. This plant —almost a refinery within a refinery—involves some of the

Sulphur being handled by grab at the sulphur bays.

The maintenance building is 800 ft. long and 180 ft. wide. Half of it is now a workshop; the other half is a store.

most complex operations in modern refinery processes. It comprises no less than four major units: (a) Propane de-asphalting plant, which washes the lubricating oil to remove asphalt; (b) propane de-waxing plant, which removes waxy compounds by crystallizing and filtering them; (c) phenol extraction plant, where phenol (carbolic acid) is used to remove certain compounds with poor lubricating qualities; and (d) clay contacting plant, which improves the colour and imparts the characteristic green fluorescence to the finished product.

The function of a naphtha stabilizer completed in February of this year, is to reprocess the virgin naphtha produced by the crude oil distillation units by extracting butane from it, which will provide an additional quantity of this gas for bottling as liquid petroleum gas. This product is used mainly for portable cooking and lighting units. The naphtha, thus treated, is said to be 'stabilized' and can be used as a component in petrol.

A polymer re-run plant completed in January last forms an addition to the existing polymerization plant, and is a simple distillation unit for redistilling the polymer produced in the process of polymerization. After re-distillation polymer becomes a high octane blending component of petrol.

Plant Under Construction

One of the construction projects now under way is a vacuum distillation tower. In order to provide an additional source of feedstock for the lubricating oil plant and the 'cat cracker,' a new distillation unit, due for completion in July, 1955, is being constructed. Also, a fluid hydroformer with a capacity of approximately 10,000 barrels a day is being installed for operation in Spring, 1956. This unit will produce a high grade of petrol component or hydroformate from a specially prepared virgin naphtha cut. In addition to the hydroformate produced, a gas suitable for other refinery operations is made available by this process.

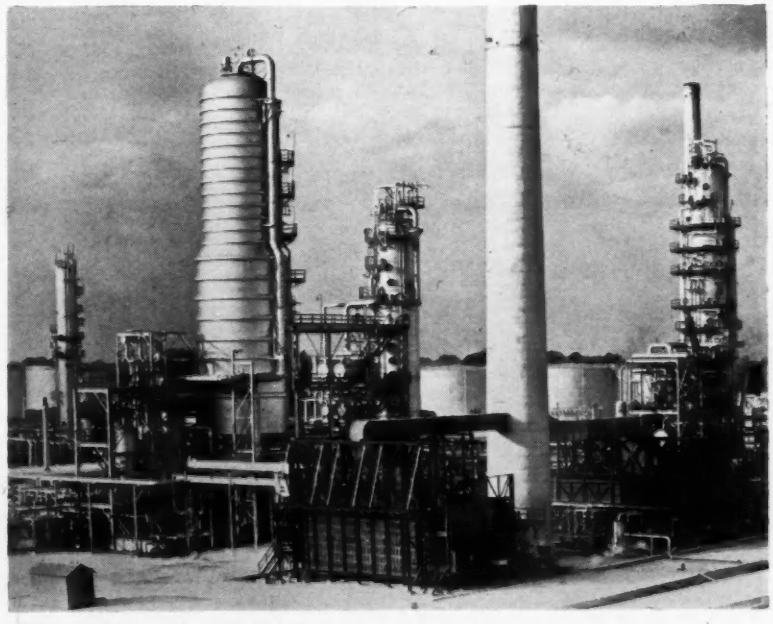
Supporting the construction programme and to provide for future development, extensions are being made to existing facilities. For example, to provide a further supply of salt water for cooling purposes in the refining process, a new salt-water pumphouse is being constructed at the jetty, together with a new 60-in. diameter salt water line to the refinery storage system.

Considerable new steam raising facilities are now being added to the refinery, and the new extensions have meant the addition of many new electrical facilities. In order to purify the additional quantities of water affected by the operation of new plant, a second oil and water separator is being constructed adjoining and similar to the existing plant. Finally, to supplement the existing fresh water supply, a 22 mill. gal. reservoir is being made, fed by a catchment scheme which traps surface water from the undeveloped portion of the refinery site.

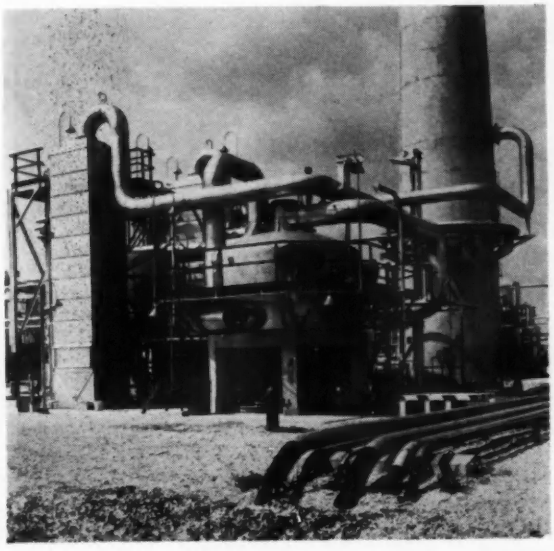
Anti-pollution Measures

Recognizing its responsibilities in the matter of air and water pollution, the Esso Petroleum Company has taken numerous measures to minimize causes for complaint.

Normal combustion products from refinery furnaces are released at a height of 250 ft. above the ground, and surplus gases are burnt at the safety flare stack; in addition, two deodorizers have been installed in order to eliminate the smell from the large quantities of spent chemicals resulting from



A general view of the crude oil distillation units.



Sulphur recovery plant, producing about 12,000 tons of 99.5% pure rock sulphur annually.

the refining processes. Hot flue gases are fed in at the bottom of a column and then rise through the chemicals, scrubbing them as they go. The malodorous gases thus produced are then burnt in a furnace.

Many of the refinery storage tanks are also fitted with floating roofs to eliminate air spaces between the oil level and the tank roof.

To meet the more complicated problem of water pollution all water used for cooling during the refining process passes through separators before it is discharged into Southampton Water. Two ballast water tanks are situated near the marine terminal for the reception of oily water discharged from ships arriving in ballast. The total capital cost of these measures to prevent pollution of the air and water was approximately £1 mill.

In addition, the following precautionary measures are in force:—

1. Emergency stops are fitted at each jetty, the operation of which automatically stops all pumps in the loading pumphouse.

2. A 'spill boom' is provided at the marine terminal ready for the immediate corralling of any accidental oil spillage.

3. Draining tanks are provided at each jetty, enabling hoses and/or manifolds to be cleared of oil.

4. An extra officer is employed in vessels trading on the coast to assist in preventing oil spillages. Four 'turnaround supervisors' are specially employed to assist ships' personnel in the prevention of oil spillage.

5. Scuppers and openings are plugged to prevent oil going overside in the case of spillage. On-the-spot investigations of any spillages are carried out.

6. A berth is made available for the reception of oily slops from vessels proceeding to repair ports. This facility has been extended to vessels other than those operated by the Esso Petroleum Company.

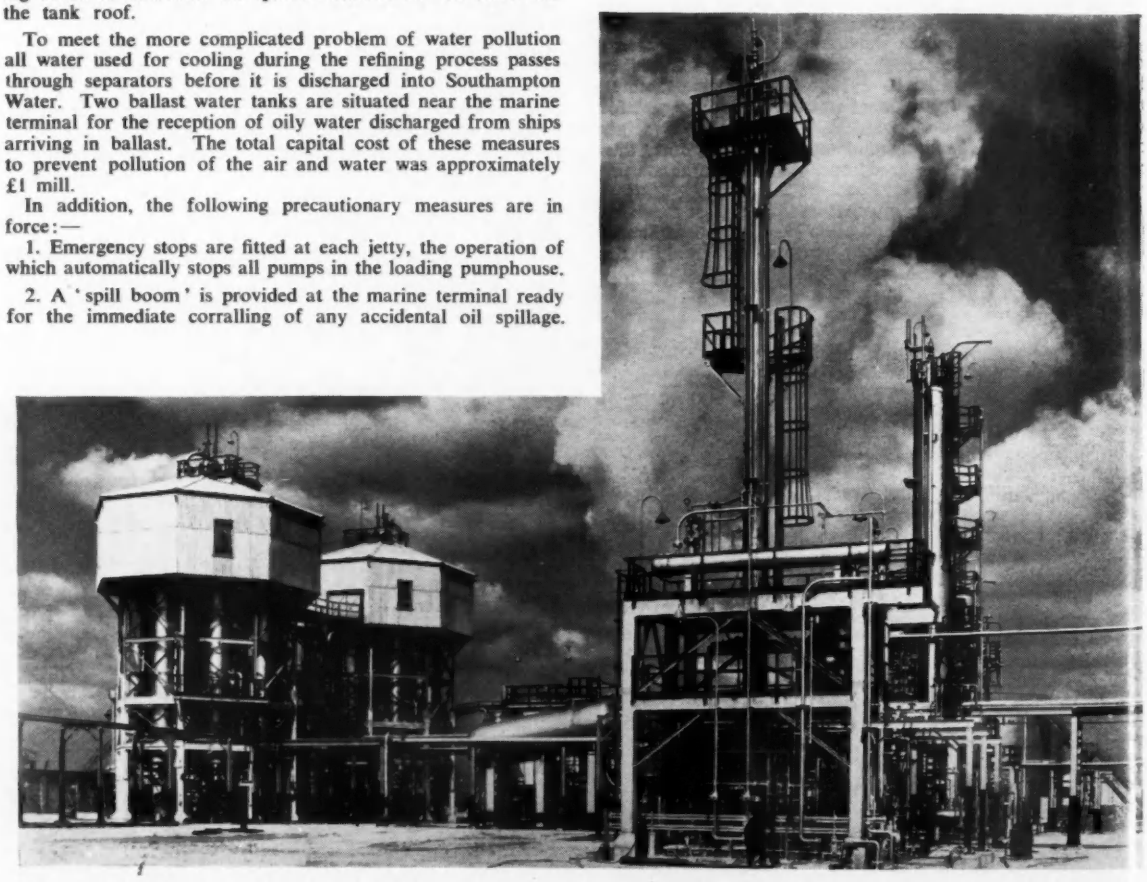
7. A slop barge is employed for slop disposal when it is inconvenient to bring a vessel alongside a berth. This barge discharges the slops into the refinery ballast tanks.

8. Those recommendations contained in the Faulkner Report on Oil Pollution which can be carried out at once, without waiting for legislation and further published regulations, have been issued as strict instructions to all ships owned by the Esso Petroleum Co., Ltd.

Amenities

A tree-belt of 5,000 trees has been planted around the landward perimeter of the refinery, which will eventually form an effective and attractive screen

The number of regular Esso Petroleum employees operating the refinery has now grown to approximately 3,000 (an increase of over 2,000 since 1950) when the old refinery, adjacent to the existing plant, was the only source of production. For this growing population the Company has encouraged a number of widespread social interests, including the provision of a modern club house and cinema, a wide range of sporting facilities, and dramatic and operatic societies.



The polymerization plant. Completed in October 1952, this plant absorbs large quantities of gas from the 'cat-cracker' and by reducing them to liquid form provides an important additional source of high grade petrol.

TOTTON TAR WORKS

A description of the works of the South Western Tar Distilleries

Photos by courtesy of The "Commercial Motor".

General view of the tar acid and tar distillation plant.

OF the 140,000 tons of crude tar per annum which are taken into the co-operative scheme trading under the name of South Western Tar Distilleries, 80,000 tons are distilled at its Totton works. This works lies at the head of Southampton Water and alongside the Totton By-pass on the Southampton-Bournemouth Road and is, therefore, well placed by sea and land for the handling of raw materials and products. Use of the former is made for receiving crude tar from the Channel Islands and the Isle of Wight, and also for the shipment of pitch, creosote and road tar to both home and foreign buyers. In 1941 the works suffered severe damage as the result of a daylight air attack by German raiders and this necessitated extensive rebuilding. The postwar closing down of the distilleries at Portsmouth and Swindon and the considerable increase in tar production have led to still more reconstruction, so that in the ten years since the war the appearance of the works has completely changed.

The activities of the works are confined to the distillation of tar and benzole and the preparation of their well known by-products. Road and rail tankers and tank barges are used to bring in the crude materials. The road fleet now consists of fifty vehicles. On reaching the works the crude tar is allowed to flow into receiving troughs and tanks and delivered by a float-controlled electric pump into the main storage tanks. These have capacities ranging from 2,000 to 5,000 tons and they will shortly be augmented by one of 7,500 tons. Settlement and removal of some of the contained ammoniacal liquor is carried out in them and continued in the two 750-ton tanks which supply the distillation plant.

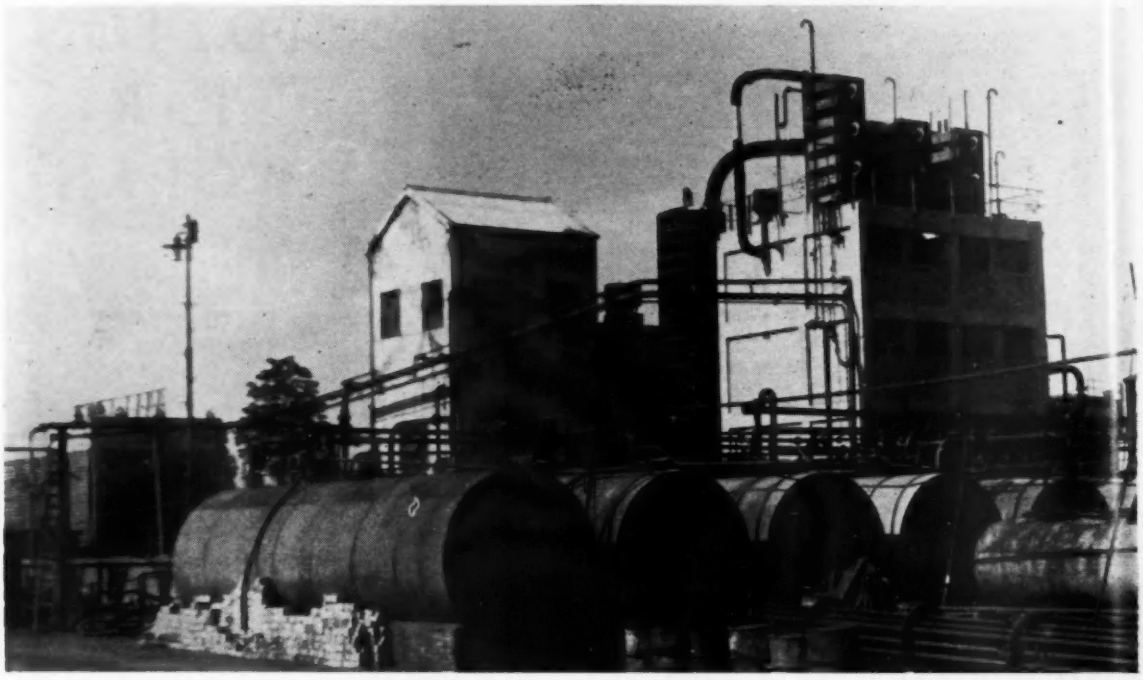
The Primary Distillation

Prior to 1950, the whole of the crude tar was distilled in a battery of seven pot-stills operated on the continuous system, and, although this plant is still maintained in reserve, it has been superseded by a pipe still of Wilton design. This unit has a daily capacity of 250 tons and its function is the separation of the crude tar into a pitch or soft pitch residue and seven oil fractions of well defined boiling ranges. Although of the usual Wilton pattern, it has a number of interesting features. The original pipe still coil was of 7 in. bore, but has been replaced by two of 4 in. bore through which the tar flow is in parallel and controlled by valves and temperature and flow recorders. Fuel gas recirculation is a common enough furnace practice to-day, but this is the first pipe still setting of its kind to which it has been applied.

On most distillation plants the circulation of the tar through the coils is done by reciprocating steam pumps, but at Totton an electrically driven 'Drum' rotary pump is used and experience has proved it to be particularly satisfactory from the point of view of maintenance. The oil fractions are removed from the 37-plate fractionating column as sidestreams, with the exception of the crude benzole, which leaves the head of the column in vapour form and is then condensed. It is important to know the rates of flow of these sidestreams, so that they may be controlled, and for this purpose rotameters of the magnetic type are employed.

The nature of the residual product is dependent upon the temperature at which the outflow from the pipe still is controlled. It may be pitch or a soft pitch, but in either case it is what may be termed the 'sticky' part of coal tar and is thus the basis of all the products such as road tar and pitch which are characterized by their binding quality. With a pipe still outlet temperature of 340°C. the residual product is pitch, which has its temperature reduced by heat exchange and is then run via coolers to the pitch beds. At Totton these have a capacity of 10,000 tons and are conveniently situated alongside the wharf for direct loading of the pitch into ships by a crane. Explosives are used to shatter the pitch in the beds which is then transferred to the crane skips by means of a shovel loader, the rate of loading being about 250 tons per day. By reducing the pipe still outlet temperature to about 290°C. a soft pitch fraction is obtained. This is run into

Tar barge breaking the ice in the River Medina.



View of the benzole plant and storage tanks.

blending tanks of capacities ranging from 5,000 to 50,000 gal., where it is oiled back with selected tar oil fractions to produce either coal tar fuels or road tars to British Standard Specifications. Road tars with a wide range of viscosities are prepared to cover the needs of the coated stone industry and surface dressing operations. These tars are conveyed in bulk from the tar works by means of road tankers.

Supplies of Road Tar

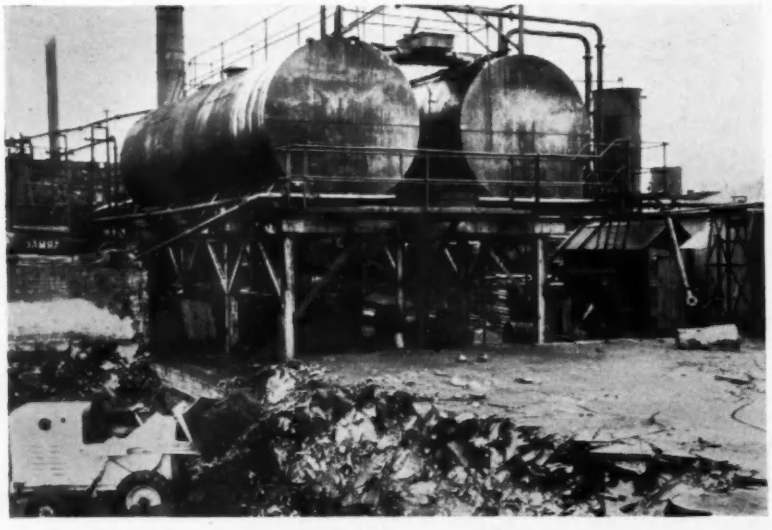
The supply of road tar from the Totton works to customers in the mid-south is carried out on an extensive scale, particularly in surface dressing work, where the tar is now mostly applied direct to the road surface by the supplier. The majority of the road vehicles, which at other times of the year are used as bulk tankers, are in the summer season fitted with tar spraying equipment to convey and spray road tar up to a radius of 70 miles. For this work, the maintenance of the tar at the correct spraying temperature is of prime importance and the efficient insulation of the lorry tanks and circulating systems has been dealt with most carefully in the interests of heat conservation.

Oil Products

The oil fractions arising from the primary distillation are the following:—

Overhead fraction	Crude benzole
No. 1 Side Stream	Heavy naphtha
2 ,, ,, ...	Carbolic oil
3 ,, ,, ...	Naphthalene oil
4 ,, ,, ...	Creosote
5 ,, ,, ...	Anthracene oil
6 ,, ,, ...	Residual oil

The last three are the higher boiling oils and are normally not further processed but blended in various proportions to provide creosotes for wood preservation purposes in markets at home, the U.S.A., Scandinavia and elsewhere.



Pitch coolers with pitch bed in foreground.

All the lower boiling oils from the primary distillation are subject to some form of extraction or redistillation process.

Of the 2 mill. gal. of crude benzole which are distilled in a year, about 300,000 gal. are provided by the overhead fraction from the tar distillation plant, the remainder being received direct from the Southern Gas Board undertakings.

For its rectification washing with sulphuric acid, alkali and water is followed by batch distillation in a steam-heated still of 14,000 gal. capacity. This fractional distillation yields motor benzole, crude toluole and solvent naphtha as well as a low boiling fraction which, when freed from carbon bisulphide by washing with ammonium polysulphide, is added to the motor benzole.

The crude toluole fraction is refined by further acid washing and distillation in batches of 7,000 gal. It yields pure toluene which has many

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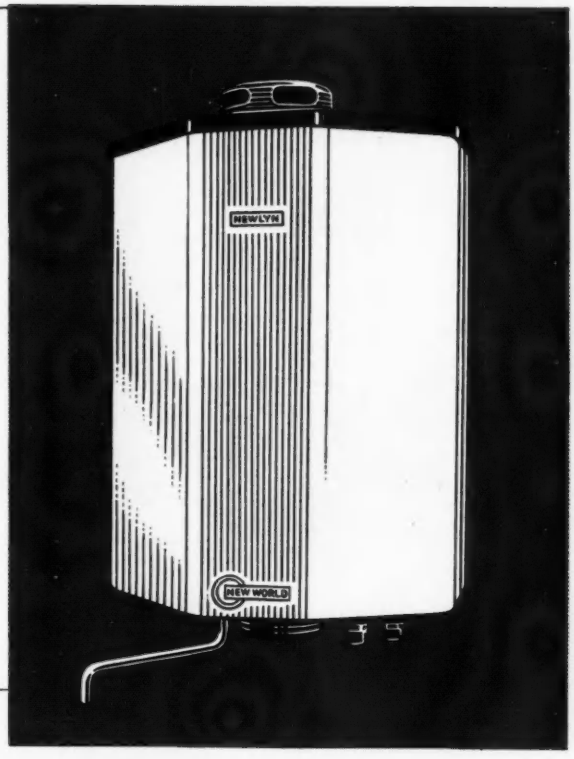

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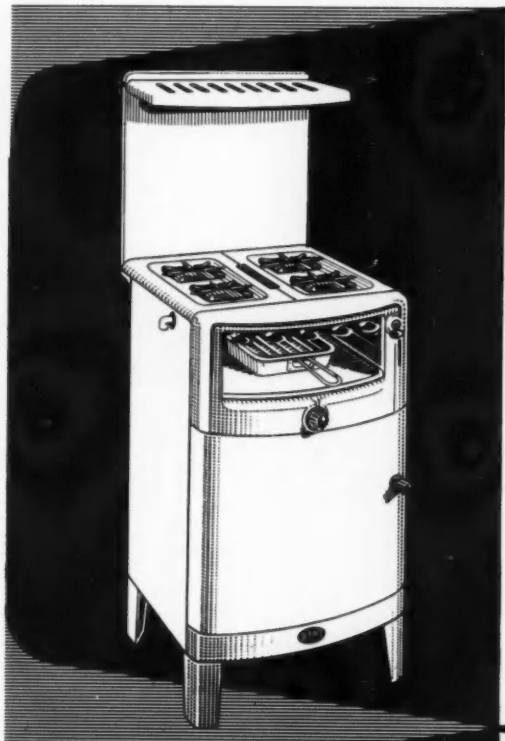

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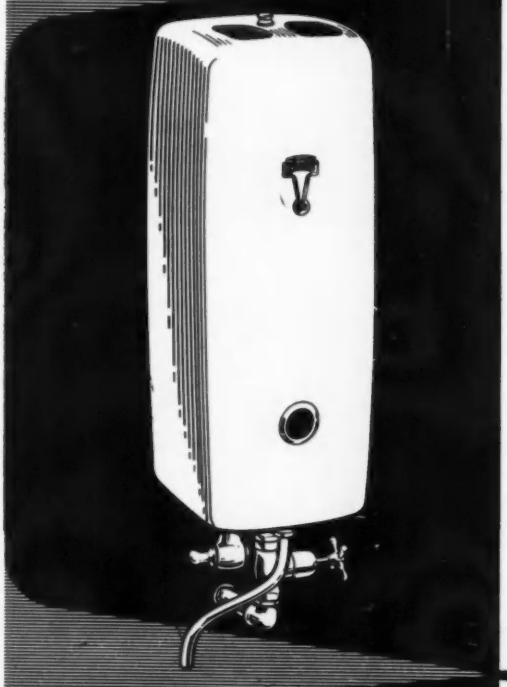

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The heavy naphtha, or the first sidestream from the Wilton fractionating column, is an oil which boils substantially between 160-190° C. It contains tar acids and tar bases, both of which are extracted at the respective plants. Washing this oil with sulphuric acid removes the bases, but the acidic bodies or phenols are extracted with an alkali, caustic soda. The latter treatment is also applied to the carbolic oil or second sidestream which contains as much as 38% of phenols.

The third sidestream or naphthalene oil contains both phenols and naphthalene; and after the extraction of the former, the washed oil is allowed to cool in open tanks, where the naphthalene crystallizes from solution. After removal of the drained oil the 'salts,' so called, are remelted and transferred to open pans where cooling promotes a second napthalene. At this stage the melting point of the naphthalene has increased considerably and the remaining operations of removal, crushing and bagging yield a material for which there is a ready demand by the manufacturers of phthalic anhydride.

Part of the fleet of road tankers based on Totton.

Tar Acids Extraction

The plant at Totton, which is employed for the extraction of the tar acids or phenols, is of quite orthodox design and operated mainly on the batch system. The essential features of this plant, which produces between 500,000 and 600,000 gal. of crude tar acids per annum, are:—

(*a*) A lime kiln in which limestone admixed with coke is burnt so providing lime for the causticizing process and CO_2 for the liberation of the tar acids from the phenolate.

(*b*) The causticizer in which lime is mixed with a boiling solution of sodium carbonate to produce a solution of caustic soda and a precipitate of calcium carbonate.

(*c*) A rotary vacuum filter in which the waste calcium carbonate in a suspended state is freed from caustic soda.

(*d*) The washers, in which mixing of the oils and caustic soda is effected by pump circulation to produce sodium phenolate.

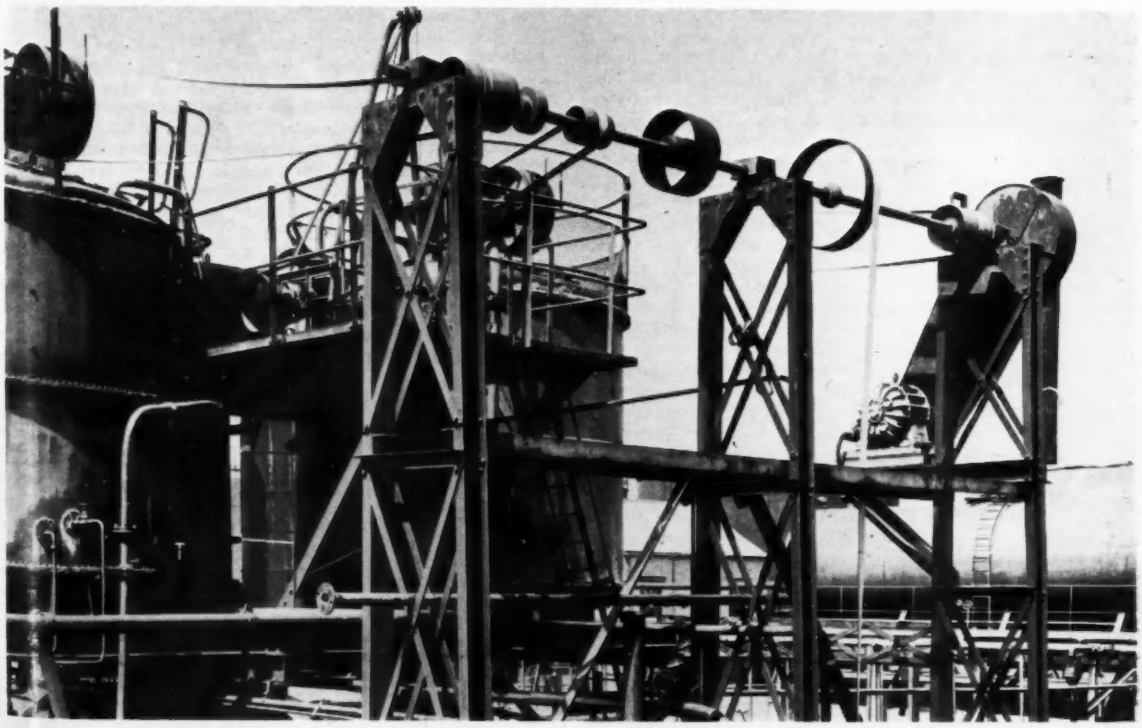
(*e*) A vessel in which the sodium phenolate from the washers is distilled under vacuum with steam heat to remove traces of contained oil.

(*f*) Packed towers through which the de-oiled phenolate is reacted with CO_2 to yield the crude tar acids and a solution of sodium carbonate.

The crude tar acids are despatched by road tank to an associated company, P. R. Chemicals, Ltd., where refining leads to the production of pure phenol, the cresols and xylenols.

The tar bases, of which pyridine is the best known, amount to but a small percentage of the crude tar, but their many and

(*Concluded on p. 721*)



A section of the pyridine extraction plant.

General view of Southampton gasworks.

Southampton Gasworks

A short description is given of this, the largest manufacturing station in the Southampton and District Group of the Eastern Division of the Southern Gas Board.

THE supply of gas to Southampton commenced at the comparatively early date of 1819, when production started at a gasworks erected on the present site by two brothers named Barlow. In 1823 the works was taken over by a private company which leased it to a Mr. S. Dunn but, after sixteen years, the Company again took possession. The Southampton Gaslight and Coke Company was incorporated by Act of Parliament in 1848. Seventeen years later, in 1865, the Shirley and Freemantle Gas Company was absorbed and, on January 1, 1937, the gas undertaking of the Winchester Water and Gas Company was taken over. The Company celebrated its Centenary in 1948 which was the year in which the Gas Act received Royal Assent. At vesting day, May 1, 1949, the area of supply of the former Company covered 188 square miles and extended from Cadnam, Lyndhurst and Fawley in the New Forest district, to Botley and Hamble in the east, and beyond Winchester to Crawley and Itchen Abbas in the north.

The Southampton works is now the largest manufacturing station in the Southampton and District Group of the Eastern Division of the Southern Gas Board; the other manufacturing stations in the Group are at Winchester, Andover, Whitchurch and Alresford, the former station at Romsey having been closed down in 1950 when that town received a bulk supply from Southampton. It is of interest to record that the first Engineer of the former Company, appointed in 1848, was a Mr. James Sharp, who is believed to be the inventor of the gas cooker. He did, in fact, carry out demonstrations in cooking by gas in 1837 and one of his original cookers is still in the Board's possession.

Southampton Gasworks

The works has a nominal daily capacity of 16 mill. cu.ft. and the whole of the plant, including stores, distribution workshops and garages, occupies a site covering only 15½ acres. The problems associated with this seriously congested site are aggravated by the fact that roads and railways split the area into five separate plots. The works is served by a wharf on the River Itchen and there is rail connection with British Railways, Southern Region.

Carbonizing Plant

There are three retort houses carbonizing seaborne Durham run-of-mine coals having a capacity of 8,620,000 cu.ft. per day.

(*a*) One bench of Woodall-Duckham intermittent vertical chambers, built in 1931.
24 120-in. retorts—3.7 tons of coal per charge.
Nominal capacity of house 2,450,000 cu.ft. per day of gas at 510 B.Th.U. per cu.ft.
The plant has a waste heat boiler and the setting is recuperative.

(*b*) Two benches of Woodall-Duckham static vertical retorts, built in 1939 and 1947.
40 120-in. retorts—2.8 tons of coal per charge.
Nominal capacity of house 4,060,000 cu.ft. per day of gas at 490 B.Th.U. per cu.ft. The two plants each have a waste heat boiler and the settings are non-recuperative.

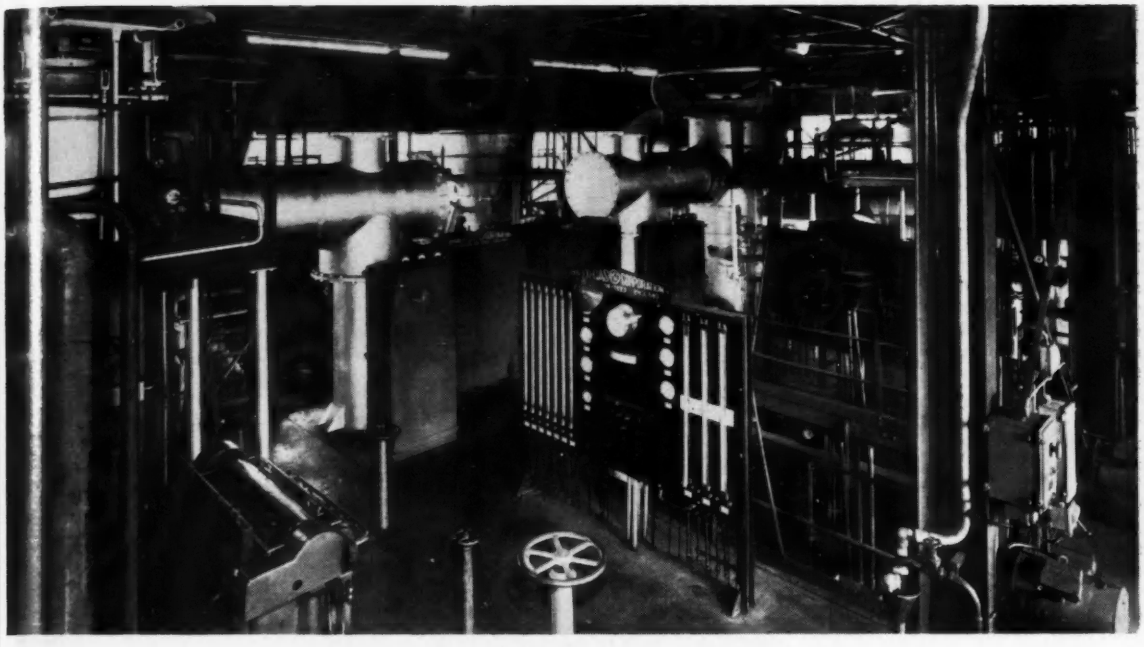
(*c*) Three benches of Drakes horizontal retorts totalling 19 beds.
Eight retorts per bed—0.5 tons of coal per charge.
Nominal capacity of house 2,110,000 cu.ft. per day of gas at 550 B.Th.U. per cu.ft. There are recuperators on these settings but no waste heat boilers are installed.

Carburetted Water Gas Plant

This comprises three units by the Power-Gas Corporation, two built in 1949 and one in 1955. Each unit has a rated capacity of 2,500,000 cu.ft. per day of gas at 500 B.Th.U. per cu.ft., being automatic hydraulically operated and having self-clinkering grates. The most recently installed set is equipped to carburet heavy oil or, alternatively, gas oil.

Coal Handling Plant

Colliers of up to 2,200 tons capacity are discharged by two 4½-ton electric cranes. A new quay wall and berth on the



Operating platform of the carburetted water gas plant.

river frontage will shortly replace the basin which vessels now use. Run-of-mine coal is handled by conveyor, either to a single roll 'Pennsylvania' crusher, or to a transit bunker from which road vehicles are loaded for Andover and Salisbury gasworks. Further belt conveyors take the crushed coal to the working stores, which hold about eight days' stock, whence it is fed to the retort house bunkers. A Strachan and Henshaw 20-ton 'Rotaside' wagon tippler is also available for discharging railborne coal, but supplies are usually seaborne.

Coke Handling Plant

A coke grading plant of 30 tons per hour capacity is fed by belt conveyors from all retort houses. The coke from the horizontal retort house is first handled by skip telpher which carries the hot coke to a quenching tank and thence to the belt system. The Fraser and Chalmers 'Gyrex' and 'Vibrex' screens are housed over a ferro-concrete bunker of 400 tons capacity and there are facilities for bulk loading, debreezing and bagging. The telpher track extends over a coke stockyard and a grab telpher is used for stocking and reclaiming the coke.

Gas Cooling Plant and Washing Plant

There are four water-cooled horizontal tube condensers, two on each of two streams of crude gas. The capacity of each pair is 5 mill. cu.ft. per day.

The gas from the three sets passes through a 'Lymn' washer and/or water-cooled vertical tube open top condensers into a relief holder of 460,000 cu.ft. capacity.

Exhausters

Coal gas is normally handled by two 350,000 cu.ft. per hour capacity Holmes-Connersville units driven by Sisson's steam engines which exhaust at 20 lb. per sq. in. back pressure for the purpose of supplying process steam to the retort houses. Two Bryan Donkin 2-blade exhausters, each of 200,000 cu.ft. per hour capacity are also available. For carburetted water gas two Holmes-Connersville machines, each of 250,000 cu.ft. per hour capacity, are used, the Sisson's engines exhausting into the same process steam system.

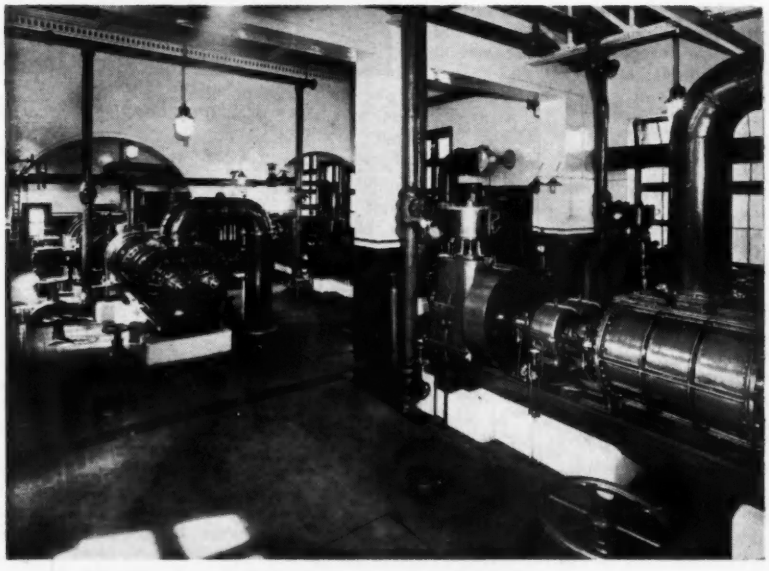
Gas Washing Plant

Coal gas is treated in two streams each of 5 mill. cu.ft. per day capacity. One stream consists of a W—W.D. electrostatic detarrer and two Holmes 'Multifilm' washers; the other stream incorporates a P. & A. tar extractor, two Livesey-type washers and a Holmes rotary washer scrubber. On the carburetted water gas stream also there is a W—W.D. electrostatic tar precipitator.

Gas Purification Plant

Coal gas and carburetted water gas streams are linked at the inlet to oxide purifiers, although there remains an old section of ground level boxes used solely for carburetted water gas. The bulk of the carburetted water gas, however, is purified after mixing with coal gas.

There are four sections of purifiers located towards the



Holmes Connersville station meters.

north of the production plant site. Two of these sections were constructed by R. & J. Dempster, Ltd., and each consists of six boxes, 40 ft. by 30 ft. by 6 ft. deep fitted with hydraulic valves and operated in series with downward flow. The boxes are elevated and are equipped with bottom discharge doors and with elevator and conveyor plant for filling. The capacity of each of these sections is 3,500,000 cu.ft. per day. The two other sections are ground level boxes, each consisting of four series and two catch boxes, the combined capacity of these two sections being 5 mill. cu.ft. per day.

Station Meters

Four station meters are used for measuring gas as made, the most modern being two Connersville units, each of 250,000 cu.ft. per hour capacity; one of these is connected in the crude carburetted water gas stream and the other in a purified mixed gas stream. The balance of the purified mixed gases is measured in a Thorp's patent rotary meter of 250,000 cu.ft. per hour capacity and the purified carburetted water gas passes through a normal wet drum meter of 80,000 cu.ft. per hour capacity.

Benzole and Dri-gas Plants

A 5 mill. cu.ft. per day Holmes oil regeneration plant is installed between the meter outlet and the gas holders. Gas oil is used in the rotary brush washer and, driven by the same engine, there is a similar washer, circulating calcium chloride solution for gas drying.

Gasholders

Town's gas storage capacity at the works totals 5,950,000 cu.ft. The principal holder is spirally guided with four lifts and is of 3,500,000 cu.ft. capacity; it was erected by R. & J. Dempster, Ltd., in 1934. District storage is available at Romsey and Eastleigh and also at Millbrook on the western fringe of Southampton where, in 1954, a spirally guided gasholder of 2 mill. cu.ft. capacity and a boosting and compressing station were commissioned.

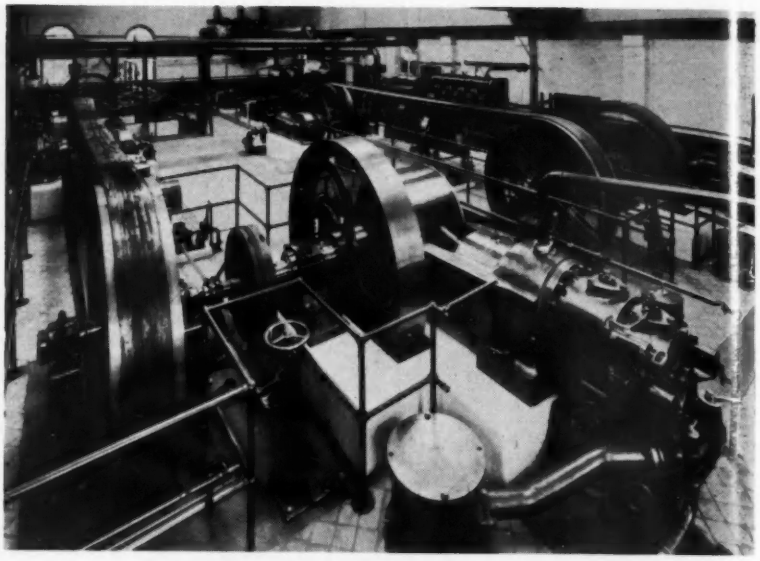
Distribution Plant

Low pressure distribution is controlled by water-sealed station governors and is augmented by boosters which also feed the bulk distribution mains to the holder stations. Boosters are electrically and steam powered, the largest being a Bryan Donkin star type machine of 1 mill. cu.ft. per hour capacity capacity at a pressure of 80 in. w.g.; this unit is driven by a steam turbine and was installed in 1949.

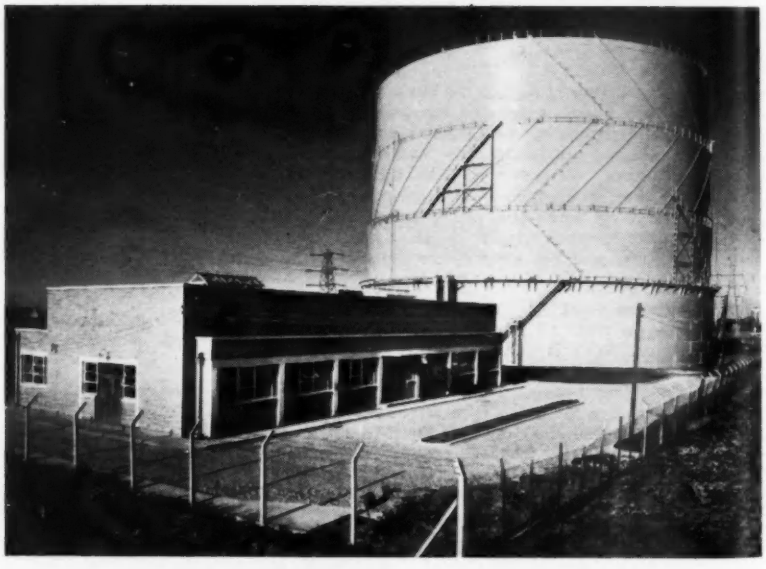
High pressure distribution to the Botley, Hamble and other districts is at pressures of up to 40 lb. per sq. in. The machinery installed includes a Bryan Donkin vertical compressor with 155 h.p. gas engine drive, a Bryan Donkin duplex horizontal compressor direct coupled to a 150 h.p. twin gas engine, and two 112 h.p. gas engines driving twin cylinder double acting reciprocating compressors. The total capacity is 200,000 cu.ft. of gas per hour at 40 lb. per sq. in. pressure.

Water Softening Plant

A Spiractor base exchange plant of 7,000 gal. per hour capacity was installed in 1948. Town's water in Southampton has an average total hardness of 180 p.p.m. of which about 70% is temporary. The treated water is used primarily for boiler feed purposes and is of zero hardness.



Gas engines driving the gas compressing plant.



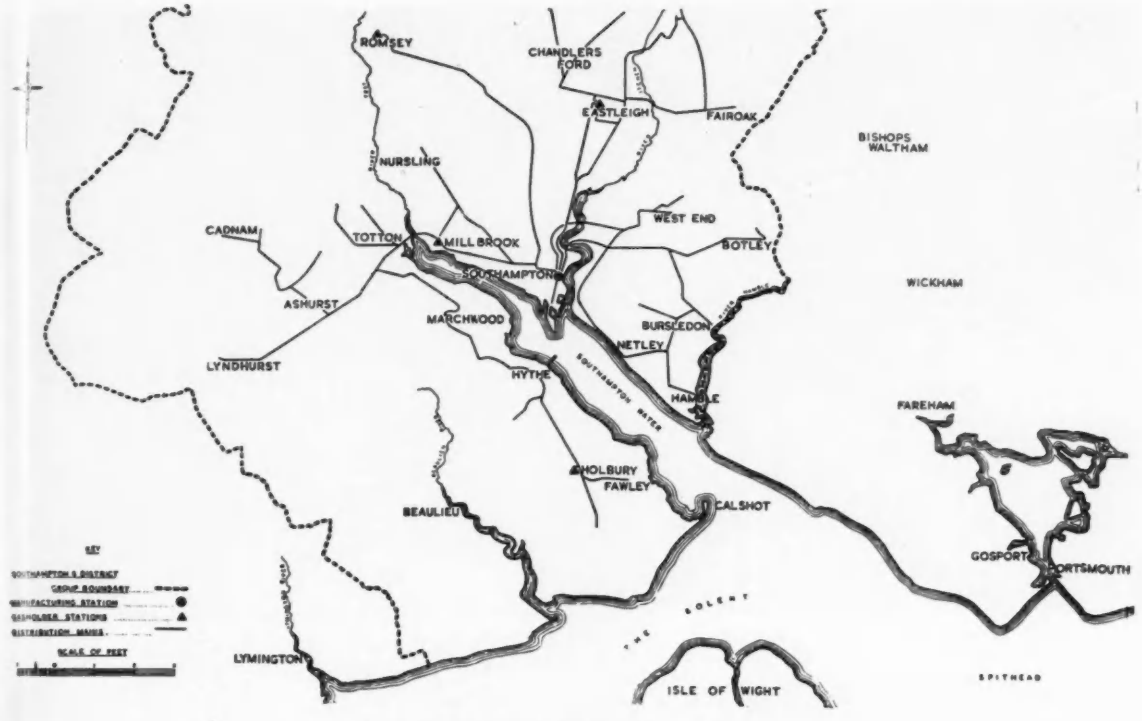
Millbrook boosting station and 2 mill. cu.ft. gasholder.

Steam Raising Plant and the Recovery of Exhaust Steam

Waste heat boilers in the retort houses and carburetted water gas plant produce about 75% of the works steam requirements. The balance is raised in breeze burning Lancashire or Cornish boilers. A scheme for recovery of exhaust steam from exhauster engines has recently been completed and this supplements the economies practised on the static vertical retort plant where a proportion of the chamber steam is supplied from the liquor pump engine exhaust.

Electrical Power

The main supply is A.C. at 6.6 kV., but the majority of the works plant is powered by D.C. motors operating at 220 V. Conversion is carried out at two points; the older plant consists of a transformer and rotary converter and the recently installed plant is a 250 kW. mercury arc rectifier. The new plant is intended to supply the peak load arising when colliers are being discharged, this load having been taken formerly by gas engine driven generators. A 500 kVA. transformer for 400 V. A.C. supply has also been connected recently and supplies the third carburetted water gas plant and an electric



Area of supply of Southampton undertaking.

blower. The transformer has ample capacity for future extensions or conversions when alternating current will be adopted in preference to direct current.

Laboratory and Calorimeters

The laboratory, which is centrally situated on the works site, is equipped primarily for routine testing of raw materials and products. A Fairweather calorimeter is the official instrument and, for control purposes, there are Sigma calorimeters operating on all gas streams.

Workshops for Building and Mechanical Maintenance

Works plant, building and mechanical maintenance is carried out from a complete range of workshops.

Fabrication of steel structures and extensive welding repairs are functions of the blacksmiths' shop, while all but the heaviest repairs are carried out on road vehicles. The works is well equipped to deal with most emergencies likely to arise and has a comprehensive maintenance system backed by an adequate stores organization.

TOTTON TAR WORKS—from p. 717

important uses in the preparation of drugs, etc., render them valuable. The heavy naphtha contains from 2-3%, and on washing with relatively weak sulphuric acid a solution of pyridine sulphate is produced. When this is neutralized with sodium carbonate in another vessel, a layer of pyridine bases separates which is dried over solid caustic soda before being despatched.

Works Services

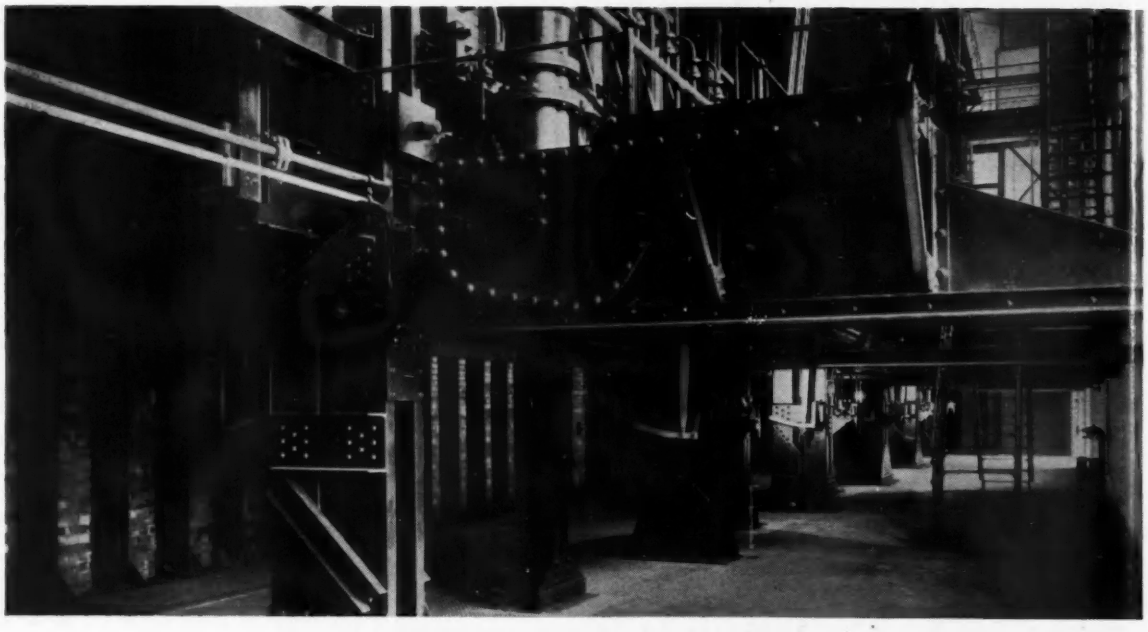
For motive power, electricity has replaced steam to a considerable extent and for this the works depends mainly upon the British Electricity Authority. The small exception concerns the Wilton distillation plant and the boiler fuel pumps for which, because of their vital nature, a standby diesel-engined generator is provided.

Cooling water for condensers is needed in considerable quantities. At one time sea water was employed but the fouling and corrosion which accompanied its use have resulted in a change to the mains supply and the installation of a forced draught cooler. The latter is of the Visco design with a capacity of 16,000 gal. per hour and the cooled water is returned to a tank on the roof of the distillation plant from which it gravitates not only to the condensers of that plant but also to those of the benzole and tar acid plants. Steam plays a large part, perhaps too large, in any works of this kind, and at Totton steam for power and to a far greater extent for tank heating and process work is generated in 30 ft. by 9 ft. Lancashire boilers. There are five of these of which three are usually in use. Tar fuel of high viscosity is burnt, the type being dependent upon the residual fraction in production at the distillation plant, and this fuel is circulated through a ring main and steam atomized in Laidlaw Drew burners. There are two Greens economizers and each boiler is equipped with a superheater of either the Unit or Sugden type. Electroflo instruments record water, steam and flue-gas temperature and in addition there are a Cambridge CO_2 recorder and draught gauges. For each boiler there is a Kent steam recorder.

The quality of the boiler-feed water is given the closest attention and is controlled from the laboratory. The water is treated in a lime soda softening plant, additional features of which are equipment for the recirculation of the precipitated sludge, and the use of sodium aluminate and magnesium sulphate. Some internal boiler treatment is also carried out to maintain a minimum concentration of phosphate in the water.

It has already been mentioned that of the fleet of 50 lorries 30 are based at Totton. They are all of Foden or Dennis make with tank capacities ranging from 800 to 2,700 gal. The majority of the Fodens tow trailer tanks so that in the tar spraying season a vehicle is able to set off in the morning with 2,250 gal. of hot road tar and surface dress during the course of the day from 10-12,000 sq. yds. of road.

The maintenance and servicing of the lorries is done on the Totton works and during the winter months a considerable amount of time is devoted to the manufacture and overhaul of the spraying equipment. Present-day surface dressing requires the machine to apply the tar uniformly and with a specified rate of cover, so that the design, preparation and testing of the equipment are matters of prime importance.



General view of ground floor of the I.V.C. house.

Hilsea (Portsmouth) Gasworks

A description is given of the largest gasmaking station of the Portsmouth, Gosport and Bognor Regis Undertaking of the Eastern Division of the Southern Gas Board.

ORIGINALLY the Undertaking was founded 128 years ago under the name of the Portsea Island Gas Light Company. Although introduced into the streets of London some years earlier, it was in June 1821 that gas lighting was first installed in the streets of Portsmouth, the majority of which were, in those days, within a radius of a mile of H.M. Dockyard, the town itself being surrounded by moats and other fortifications which have long since disappeared. After 1926 the acquisition of the Havant, Emsworth, Hayling Island and Gosport Gas Companies added considerably to the area of supply, while in 1947/8 a bulk transmission main was laid northwards to the Petersfield works of the Petersfield and Selsey Gas Company.

On the nationalisation of the gas industry in 1949, the following additional companies were merged with the Portsmouth and Gosport Gas Company to become the Portsmouth, Gosport and Bognor Regis gas undertaking of the Southern Gas Board, which now covers approximately 440 sq. miles of territory with a population of some 518,870 persons:—

Bognor and District Gas and Electricity Company (which included Chichester).

Petersfield and Selsey Gas Company.

Titchfield District Gas Company.

Since nationalisation bulk supplies of gas have been provided to Chichester and Titchfield, while plans are now in hand for the closure of Selsey works.

The growth of the Undertaking since 1949 has been as follows:—

Year	Cu. ft. of Gas Made (millions)	Number of Consumers
1949/50	5,148	121,343
1950/51	5,285	123,505
1951/52	5,301	125,587
1952/53	5,408	127,891
1953/54	5,427	131,533
1954/55	5,623	135,600

Manufacturing and Storage Stations

Gas is at present manufactured at the five works of the Undertaking as follows:—

(1) Hilsea works, by far the largest, has a potential daily output of approximately 18 mill. cu.ft. of gas and storage facilities for 5 mill. cu.ft. The works is on a comparatively modern site having been constructed in 1905.

(2) Flathouse works, the oldest manufacturing station, is situated on Portsmouth Harbour and is equipped with chamber ovens, horizontal retorts, and carburetted water gas plant. The potential daily output is approximately 4 mill. cu.ft. with gas storage on the site for 1,500,000 cu.ft. Seaborne coal from the Northumberland and Durham mines is received regularly at the Flathouse wharf for distribution by road vehicles to the other works.

(3) Gosport works is situated on Haslar Creek on the western side of Portsmouth Harbour, and the retorts are of the horizontal type. Carburetted water gas plant is installed, and this station has a daily output of 2 mill. cu.ft. and a gas storage capacity of 1,500,000 cu.ft.

(4) The Bognor works, located at Shripney, has a potential daily capacity of 2 mill. cu.ft., the gas being derived from horizontal retorts and carburetted water gas plant, while the gas storage on the site amounts to 1,500,000 cu.ft.

(5) Selsey works has horizontal retorts, capable of producing 100,000 cu.ft. per day, while the gas storage capacity is 100,000 cu.ft.

In addition to the storage accommodation on the works' site there are gasholders at Rudmore in Portsmouth (1,500,000 cu.ft.), Emsworth (1,500,000 cu.ft.), Fareham (1,000,000 cu.ft.), Bilsham (250,000 cu.ft.), and Bishop's Waltham (100,000 cu.ft.), giving a total storage capacity, with works holders, of 13,950,000 cu.ft. A further gasholder of 1,000,000 cu.ft. capacity is now in process of erection at Leigh Park near Havant.

The Hilsea works was constructed between 1901 and 1905 and has been extended from time to time to its present area of 34 acres. Some 65% of the total gas requirements in the Undertaking's area of supply are provided from this station, and with a total of 58 acres of land available for gasmaking purposes, sufficient space exists for future development. It is fortunate in this connection that the works occupies a good

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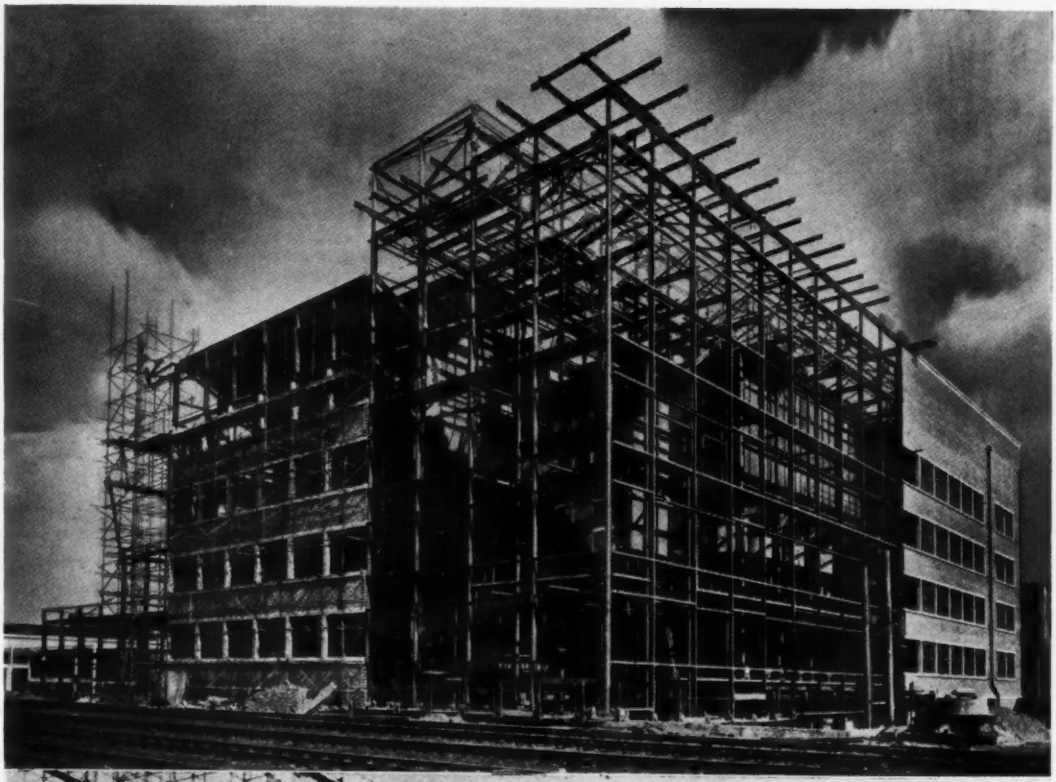
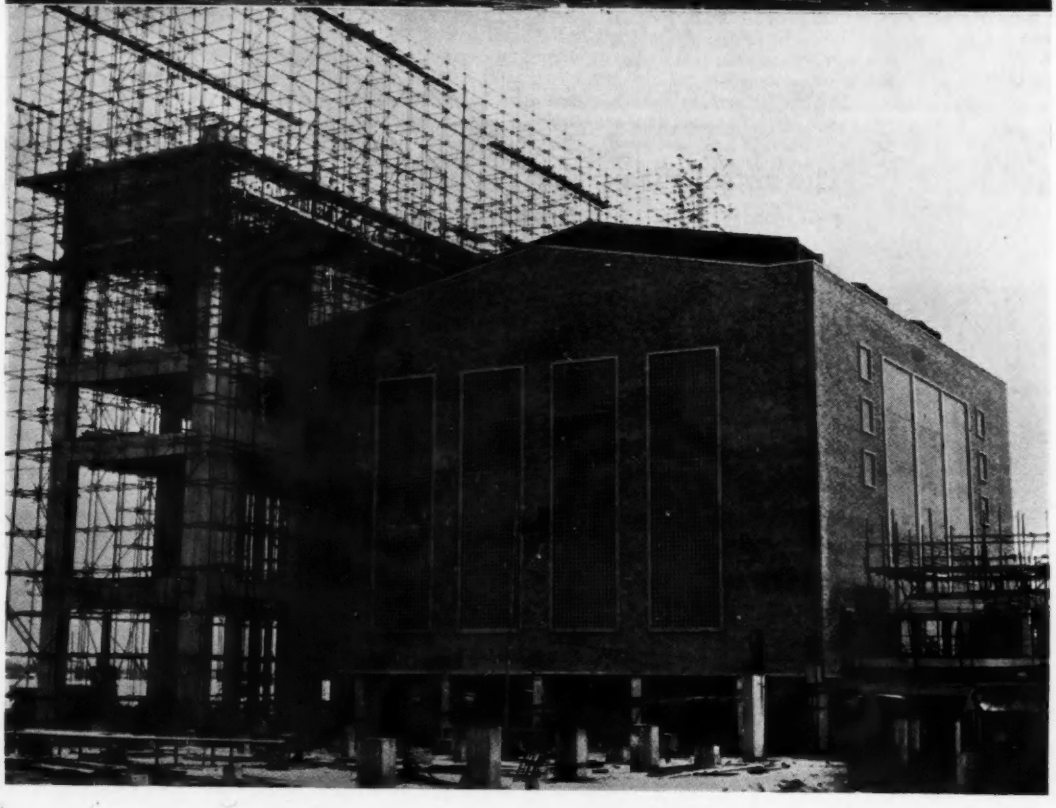


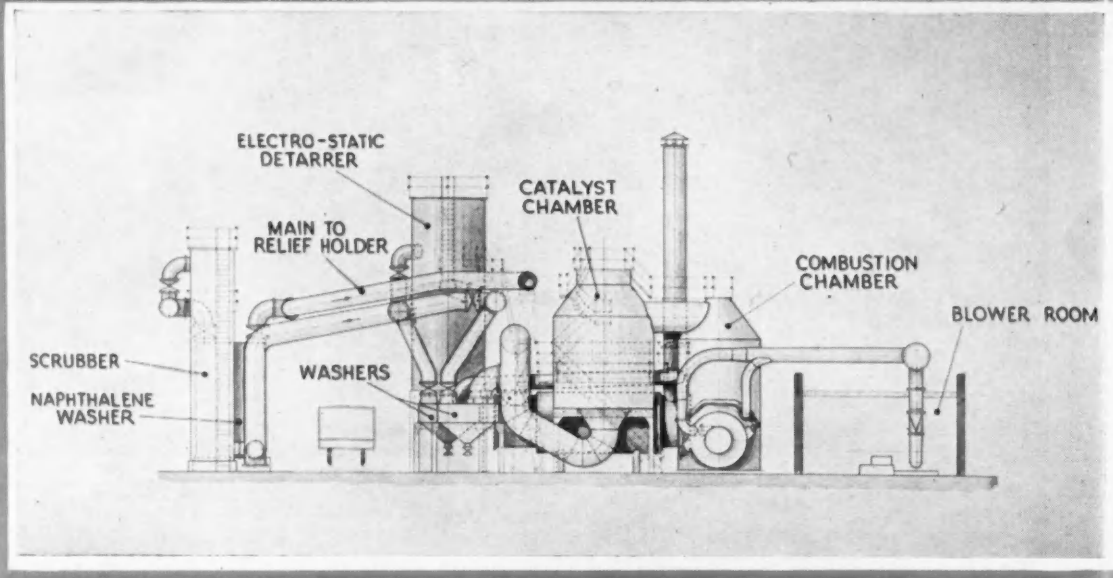


Photographs by courtesy of the North Western Gas Board

2,000,000 CU. FT. PER DAY

ONIA-GEGI CATALYTIC OIL GAS PLANT

for Hilsea Gasworks, Portsmouth



The above Plant which is under construction for the Southern Gas Board, is the initial section of a proposed 8,000,000 cu. ft. per day installation.

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st ategical position for the distribution of gas to the country ar as since town planning of densely developed districts such as Portsea Island inevitably requires the decanting of consider-ab e sections of the population to new sites.

C al Handling Plant

Until the close of 1948 coal was delivered by specially con-st ucted road wagons from Flathouse works to a loading dock, w ence it was tipped direct into railway wagons and hauled by steam locomotives to an elevated track in rear of the retort ho se. This method has now been superseded by an installatio of belt conveyors, capable of moving 250 tons of coal per ho r from ground level to the same position previously reached by railway wagons, and the road vehicles tip directly into a re iving hopper which feeds the conveying system. A rail wa on tippler removed from the overhead track has been ar nged to discharge into the same hopper, in order to handle rai borne coal received from the stocking ground, or direct fro n the collieries, should this practice become necessary at an time.

Coal Stocking

An area of some 14 acres is available for coal stocking, and quantities of up to 60,000 tons have been held on occasions. Stocking and reclamation is carried out by means of locomotive steam cranes, forward-acting diesel shovels, high-lift shovels, portable conveyors and rail wagons or motor lorries.

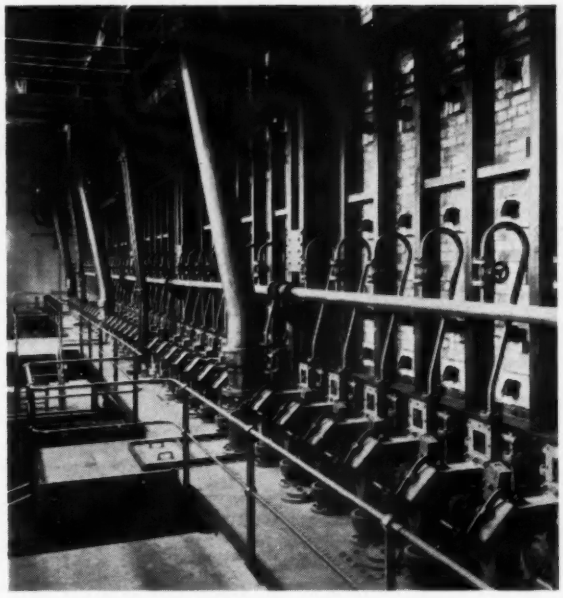
Coal to the Carbonizing Plants

From the discharge points on the belt conveyor system coal is fed to the two intermittent vertical chamber oven plants through single roll Jeffrey Diamond coal breakers and 70 tons per hour balanced automatic skip hoists. Coal to the continuous vertical retort benches is taken through similar crushers and then elevated by one or other of two lip bucket conveyors, the capacity per hour of these units being 50 tons each.

Carbonizing Plant

Coal is carbonized in either intermittent vertical chamber ovens or continuous vertical retorts, and the plant is arranged in four separate benches as follows:—

No. 1 Bench. This bench, while incorporating the foundations and a certain quantity of steel work utilized in the construction of a set of continuous vertical retorts in 1921, was drastically rebuilt between 1946 and 1948, and now consists of two settings, each of 18, 62-in. continuous vertical retorts designed by the Woodall-Duckham Company on their lambent heating principles. The benches are complete with all modern ancillaries and waste-heat boilers, and are equipped with coal bunkers giving a storage capacity of 480 tons. The capacity of the bench is approximately 2,700,000 cu.ft. per day.



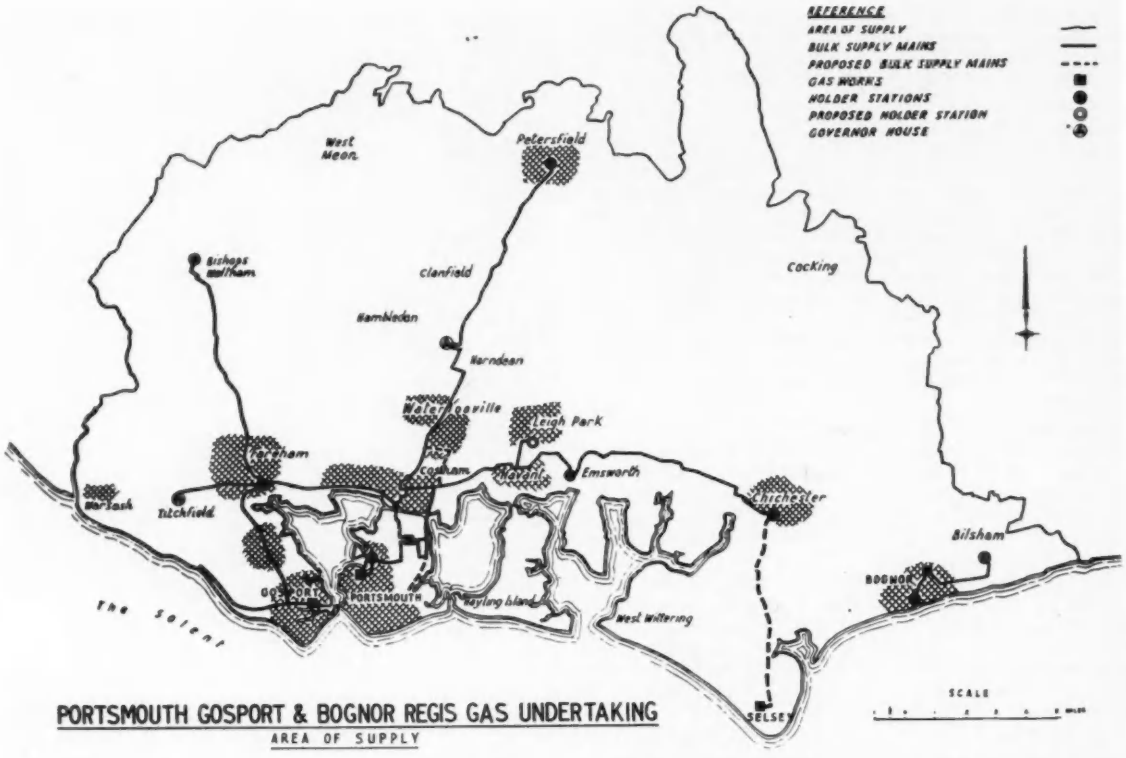
Bottom offtake platform in the I.V.C. house.

No. 2 Bench. This bench, which is housed in the same general retort house building as No. 1 bench, was constructed in 1924 by the Woodall-Duckham Construction Co., Ltd., and consists of 28 5-ton continuous vertical retorts 4 ft. 3 in. by 7 in. at the top, tapering outwardly to 5 ft. 3 in. by 19 in. at the bottom. This plant, which is very old, is now only used for gasmaking under extreme peak load conditions, and is capable of an output of approximately 1,500,000 cu.ft. per day. Coal storage capacity of 440 tons is provided.

No. 3 Bench. No. 3 bench was constructed in 1933 within the walls of the original inclined retort house and consists of thirty-five intermittent vertical chambers, each of 3.67 tons capacity. The plant has a nominal output of 3,200,000 cu.ft. per day. The coal storage bunker of 600 tons capacity is mounted over the bench and is fed by a 70-ton per hour skip hoist. These chambers were designed and erected by the Woodall-Duckham Construction Co., Ltd.

No. 4 Bench. No. 4 bench of ovens consists of 42 chamber

Charging platform, Nos. 3 and 4 benches.



PORTSMOUTH GOSPORT & BOGNOR REGIS GAS UNDERTAKING
AREA OF SUPPLY

ovens of identical design and capacity to No. 3 bench, and was constructed in 1940 to give a nominal output of 4 mill. cu.ft. per day. It is also accommodated within the walls of the original inclined retort house and forms, with No. 3 bench, an almost continuous range of chamber ovens. No coal bunker was constructed at the time the bench was built, and coal was drawn from the existing storage over No. 3 bench. After the war, however, the construction of a suitable bunker was undertaken, and in 1949 a similar coal storage and elevating installation to that attached to No. 3 bench was completed in respect of No. 4. These two coal bunkers and skip hoists can serve either bench with equal facility, and provide between them approximately 48 hours of coal storage.

Carburetted Water Gas Plant

Four carburetted water gas plants are installed, two of them being hand-operated, of a nominal capacity of 1 mill. cu.ft. per day with a common waste heat boiler, while the other pair are automatically operated with a nominal capacity of 2,300,000 cu.ft. per day each. The newer of the automatic sets is hydraulically operated, while in the other, the operation is mechanical. All four plants were manufactured by Humphreys & Glasgow, Ltd.

Coke Handling, Screening and Storage

Coke from the two continuous vertical and the two intermittent vertical chamber retort houses is collected by telpher and transferred either to one of two screening plants or to a storage space for ungraded coke, capable of accommodating upwards of 4,000 tons. Graded or ungraded coke and breeze is also moved by the same plant to the overhead bunkers in both the carburetted water gas plant house and the boiler house.

The screening plant is arranged in two units, the first of which is incorporated in a set of reinforced concrete bunkers of some 280 tons capacity. Normal type cutters and oscillating screens of 15 tons per hour capacity, constructed by Robert Cort & Sons, Ltd., are utilized, and loading facilities exist for both road or rail wagons, A.C.E. de-breezing screens and Belle Isle weighing machines being situated at the outlet of the hopper bases. The second screening plant is equipped with a cutter and a standard form of rotary screen, having a capacity of 10 tons per hour, the hoppers beneath giving storage for 150 tons. Facilities exist on this plant also for loading coke into road or rail wagons. Additional storage space for graded or ungraded coke is provided in the same area as is used for coal stacking, and upwards of 17,000 tons of coke have been held in stock at the commencement of the winter period.

Gas Treatment

CONDENSERS. The condensing of gas passing from any of the four retort benches is accomplished by horizontal atmospheric condensers or vertical water tube condensers, the units being arranged for working either in parallel or in series. In 1948 the gas condensing plant was augmented by the installation of a 4 mill. cu.ft. per day Whessoe condenser, complete with a Visco water cooling unit, while a similar unit has been added to an existing set of vertical water tube condensers. Water gas is cooled by similar methods.

EXHAUSTERS. Exhausting capacity is provided by one 4-bladed exhauster of 300,000 cu.ft. per hour capacity, driven by a horizontal steam engine and two similar machines of 150,000 cu.ft. per hour capacity, and constructed by the Bryan Donkin Co., Ltd. In 1949 a Waller Rootes-type exhauster of 400,000 cu.ft. per hour capacity was installed, being driven by compound high speed vertical steam engine, removed from a former electric generating set.

DETARRERS. There are three 7 mill. cu.ft. per day Holmes electrostatic detarrers, two for coal gas and the third for water gas. The coal gas units are placed at the immediate outlet of the exhausters.

WASHERS. There are four static ammonia washers, two of 3 mill. cu.ft. per day capacity each, and two of 4 mill. cu.ft. per day capacity each.

PURIFIERS. From the outlet of the washers the coal gas passes to one or other of two sets of purifiers. The purifiers are all of the ground level type, one set comprising four boxes 36 ft. square with two catch boxes, and the other set four boxes 50 ft. by 45 ft. with centre valve and two catch boxes 40 ft. by 36 ft. Carburetted water gas is purified separately in one set of six boxes, each 36 ft. square.

METERS AND OTHER PLANT. Three station meters of the wet drum type are installed together with two of the Holmes-Connersville pattern. Gas dehydration is practised, a rotary washer and plant by W. C. Holmes & Co., Ltd., being incor-

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perated. Benzole is also extracted by a normal oil washing plant.

GASHOLDERS. There are two gasholders on the works, the larger having a capacity of 3 mill. cu.ft. in four lifts, equipped with column guides, and the smaller, which is of the spirally guided type, has a capacity of 2 mill. cu.ft.

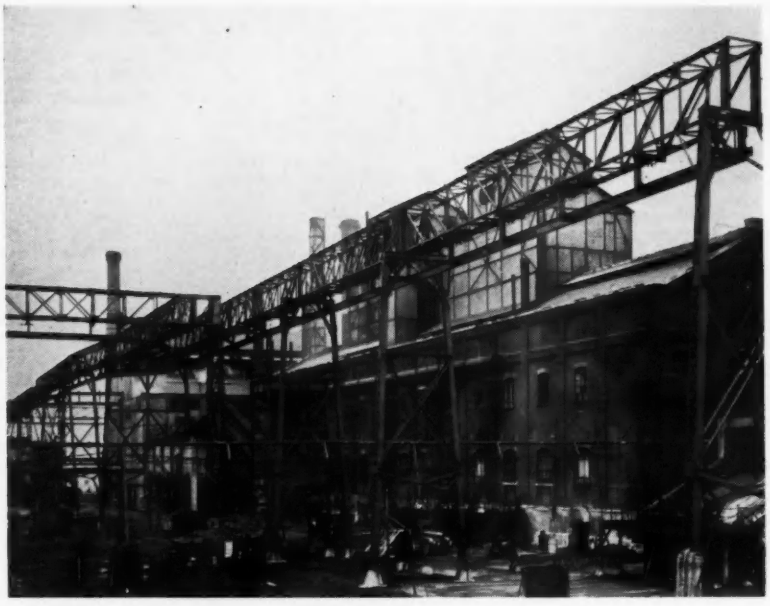
Station Governors and Boosters

The governor house contains two station governors, one of 30 in. diameter, controlling the supply to the Copnor and Milton districts of the City, and the other of 15 in. diameter, regulating the gas supplied to the Cosham district. There is also a 24 in. governor (supplying Southsea district) situated in the roadway and controlled by a relay in the governor house.

The house also contains two turbo-driven boosting sets of the open fan type, each capable of dealing with 500,000 cu.ft. of gas per hour, and two similar sets with a capacity of 750,000 cu.ft. per hour. Gas to the outlying districts is handled by two sets of steam-driven multi-stage turbo boosters of 250,000 cu.ft. per hour working at a maximum of 3 lb. per sq. in. outlet pressure, together with two more recent sets, one steam and one electric, each capable of passing 350,000 cu.ft. per hour against a pressure of 5 lb. per sq. in.

Steam Raising Plant

In addition to waste heat boilers working in conjunction with the coal gas and carburetted-water-gas plants, there is a setting of six 30 ft. by 8 ft. Lancashire boilers, three fired by hand and three by means of Danks 'Oldbury' stokers. A wet back marine boiler having an output of 10,000 lb. of steam per hour is also installed.



Telpher track and coke grading plants.

Reconstruction and Extensions

To mitigate the local effects of burning fine coke breeze on chain grate stokers, a cyclone grit catcher has been installed to serve the setting of six Lancashire boilers, and the opportunity was also taken at the same time to incorporate an economizer.

An installation of four mild-steel welded tray purifiers is now in course of erection, complete with overhead gantry crane, revivifying floor, etc. The plant comprises four purifiers, each 42 ft. 9½ in. long by 29 ft. 6½ in. wide by 13 ft. 8 in. deep, and containing eighteen trays 12 ft. 6 in. square by 3 ft. 10 in. deep. These purifiers are scheduled for completion and putting to work by mid-autumn, 1955.

A catalytic oil gasification plant with a nominal output of 2 mill. cu.ft. of gas per day and operating on the ONIA-GEGI process is on order and is due to commence gasmaking in the summer of 1956.

Plans have been approved for a bulk supply of gas to be taken from the holder station at Chichester to Selsey works, feeding a number of villages *en route*.

BACKBONE MAIN—from p. 690

the grid. This is provided for by two control centres, situated at Derby and Leicester, staffed by shift grid controllers. Each divisional control centre is responsible for controlling the volumes distributed throughout its divisional grid system, and is provided with telemetering equipment and remote indicators for providing meter readings of inputs and offtakes of gas volumes into and from the 'backbone' system. At certain points where volume controllers are fitted, these also will be controlled remotely from Derby and Leicester. The two control centres at Derby and Leicester are in frequent communication throughout the day, although the daily volumes flowing between the two divisions will not be subject to much variation and will conform to a prearranged programme. This is not the case within the divisions, where hourly information is necessary both for gas inputs and outputs and holder stocks connected to the divisional grid. This control, which has been in operation in the Notts. and Derby Division for some time past, enables holder stocks and manufacturing plant to be used in the most efficient manner.

By way of example of the effectiveness of this control, the authors would mention the position during the peak demands of the past winter where holder stocks within the Notts. and Derby Division at the commencement of the week amounted to a total of 33 mill. cu.ft. By Friday evening, holder stocks totalled only 8 mill. cu.ft. after distributing approximately 75 mill. cu.ft. daily. This question of the control of bulk distribution on an integrated grid system is a subject that would provide a separate paper in itself and can only be briefly referred to here.

THE DOMESTIC LOAD—from p. 700

risk that as an industry we might become known as single-purpose hot water providers.

As an industry, we must strive much harder for making more popular the water heater that provides a complete house service either by means of the instantaneous or storage type of appliance. The electric immersion heater is the constant threat in this field and will so continue while it holds the advantage of simple fixing, maintenance calling for only occasional element replacement, and reasonable running costs in many areas.

It is suggested that while maintaining all possible endeavour to install existing types of gas water heaters, urgent consideration should be given to developing a heater capable of simple attachment direct to existing hot water storage cylinders and of such low thermal input that flueing is unnecessary, or, if of larger input, with a flue constructed with the purpose in mind not merely of ventilating products of combustion, but also of providing means to act as an airing cupboard heater.

It is conceivable that future development of the washing machine could be along the lines of a machine and clothes-drying cabinet combined in one appliance, in place of the separate appliances now available, but the latter so infrequently used because of cost and lack of available space in many kitchens. It can be visualized that warm gas-heated air, blown by a fan operating from the electric motor, carried *via* ducting to a side-attached enclosed compartment could provide a drying service. The outlet from the drying compartment might lead back into the washing machine pan where the moisture-laden products could condense and eventually be run off from a pan outlet tap.

PUMPING OF LIQUIDS—From p. 696

pumps are associated with either viscosity and fluid-friction, or internal slip. The fluid friction losses increase with rising speeds, but slip being independent of speed, becomes proportionately less as the output from the pump is raised by increasing the speed.

For each type of pump, therefore, there is an optimum speed at which the combined fluid friction and slip losses for a particular liquid are at a minimum. With liquids of low viscosity, friction becomes less important and the optimum efficiency point moves into the higher speed ranges where the relative effects of slip become less significant. With high viscosity fluids the converse applies.

Many works operations necessitate raising liquids from deep wells, and for these duties pumps of the plunger, air lift, vertical spindle centrifugal, and submersible types are available. Of these, the latter are of particular interest as the integral motor and centrifugal pump unit can be submerged in the well water; they are also of high efficiency and offer considerable advantages over the air lift type. Fig. 34 of the paper illustrates one of these pumps, many of which have been installed in gasworks, and it is not unusual for the cost of raising well water to be reduced from about 1s. per 1,000 gal. with an air lift pump to 4d. per 1,000 gal. with a submersible pump. A high standard of reliability has been obtained and a 20,000 hours' run is normal between periods of inspection. The pumps are manufactured in a wide range of sizes suitable for boreholes from 6 in. to 14 in. diameter and the larger units deliver 100,000 gal. per hour and absorb 150 h.p.

The success of any pumping installation depends as much upon the correct choice of pipe size and good layout as on the selection of the most suitable pump. It is first necessary to determine the optimum size of pipe for the specified duty that would incur a minimum overall cost as made up of the combined capital charges and cost of power for overcoming the pipe resistance. In the second place, it is necessary to ensure that the pump selected is working as near as possible to its point of maximum efficiency. Suggestions for economic sizes of pipes for different flow conditions are given in the paper, while Fig. 35 shows how the pump characteristics should be matched to the resistance of a particular system, and it will be noted that the point of maximum pump efficiency occurs at around the normal operating condition.

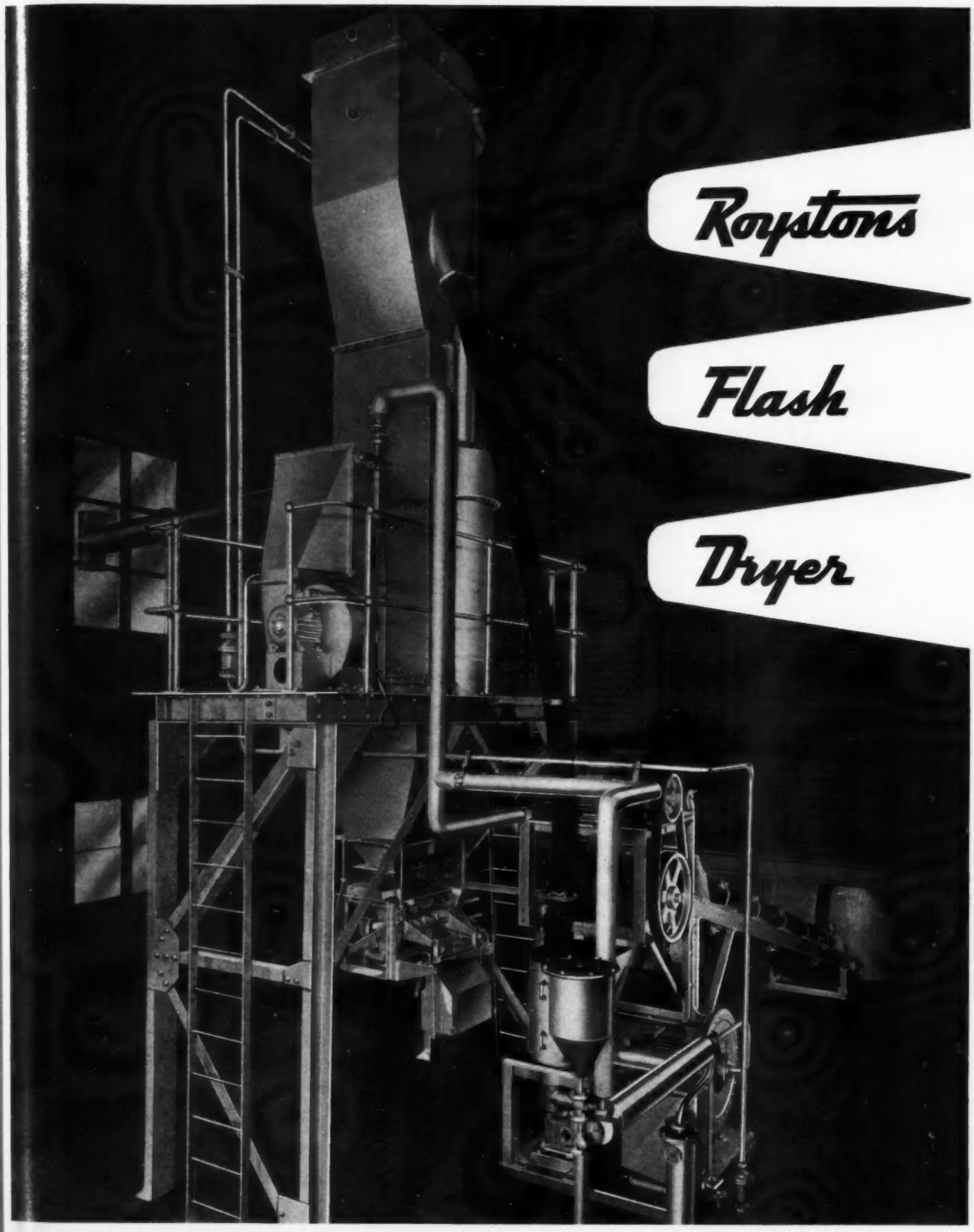
TOWN GAS IN INDUSTRY—From p. 698.

problem considerably. The use of electrical aids in this modern age is growing and must be encouraged. If it is possible to design an appliance to operate without the aid of electricity (e.g., a thermostatically controlled solution heating tank), then it is desirable to do so, but where, for instance, conveyors, compressors or other electrically operated devices are required, then electricity has to be provided, and the utmost use should be made of it. In this connection, more work requires to be done on ventilation of appliances. The value of induced-draught fans, for instance, was stressed recently by Bennett and Reichert in a paper to the Institution of Gas Engineers. Where units are fitted into a production line, saving of space is always worthwhile, and in many cases the use of smaller flues, combustion chambers and burners would be possible with the aid of induced draught.

The great advantage of flexibility enjoyed by gas must be used to the full. The horizons are widening steadily, in that industrial plant now burns gases made from conventional carbonizing and coking plants, from oil, methane and other gases recovered from coal mines or refineries, butane and like petroleum fractions, and lean gases down to a calorific value of 50 B.Th.U. per cu.ft. The use of each of these has in the past been a specialist field, but it is believed that the range of application of all these gases will grow.

The specialist Anglo-American productivity team for the investigation of Industrial Engineering, which visited the United States of America in 1953, said in its report: 'The industrial engineer enters industry with the conviction that the practice of today will be swept aside tomorrow and it will be his job to do it.' It is necessary to be prepared to design, produce and service the plant which will surely be required to fulfil this aim. This paper has endeavoured to give some picture of the framework within which the industrial engineer of the gas industry has to work, to present a few examples of the problems that arise, and to stress the complications that often attend the designing of industrial gas equipment. It is not sufficient to produce an appliance that will give satisfactory combustion and thermal efficiency; the appliance must also survive the conditions obtaining in the industry for which it is destined. To this must be added the necessity, in nearly every case, of passing from the drawing-board to the manufactured appliance without the possibility of an intermediate development stage.

Members assemble at the entrance to the South Parade Pier Pavilion.



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Works Visits and Social Events

(Left to right): J. T. Haynes, Sydney Smith, H. M. Lawrence, W. K. Hutchison and R. M. Farror at Hilsea works.

THIS year, as in previous years, the social side of the Institution meeting was well covered, and a staggering selection of visits was laid on, ranging from a tour of a brewery (especially for the gentlemen) to a trip around a corset factory (for ladies only). Included in the list were, of course, a number of gasworks and other places of particular interest to the gas engineer. For most of the four days, the weather came up to one's expectations of 'Institution Week,' although by the Friday it had deteriorated from the brilliant start on Tuesday; this did not, however, reduce anyone's interest in the later visits.

Apart from the visits to works, factories, dockyards, etc., there were two major social events, the first of which took place on the evening of Tuesday, May 24. This was the reception and dance in the Savoy Ballroom, Southsea, where, after the reception by the President and Mrs. W. K. Tate at 8.30 p.m., dancing and convivial conversation continued until well after midnight. A large number of members and their ladies attended this function, and it was amusing to note what interest their arrival at the Ballroom had for holidaymakers to Southsea, who lined the promenade to get a grandstand view of what was quite an event, even in such a resort. The second purely social function to take place at Southsea was the Civic Reception by the Lord Mayor and Corporation of the City of Portsmouth in the South Parade Pier Pavilion, at 8 p.m. on the Thursday. The proceedings commenced with a theatre show in the Pavilion, followed by the reception, after which there was dancing for those who felt 'in the mood.'

The largest gasworks in the Eastern Divison of the Southern Gas Board (Mr. Tate's division) is that at Hilsea (Portsmouth), and tours of this works were arranged for Wednesday and Thursday afternoons. The gasmaking capacity of this works is about 18 mill. cu.ft. per day, coal gas being produced in two benches of intermittent vertical chamber ovens and two benches of continuous vertical retorts, while water gas is manufactured in four sets, two of which are automatically operated. A brief description is given on p. 722.

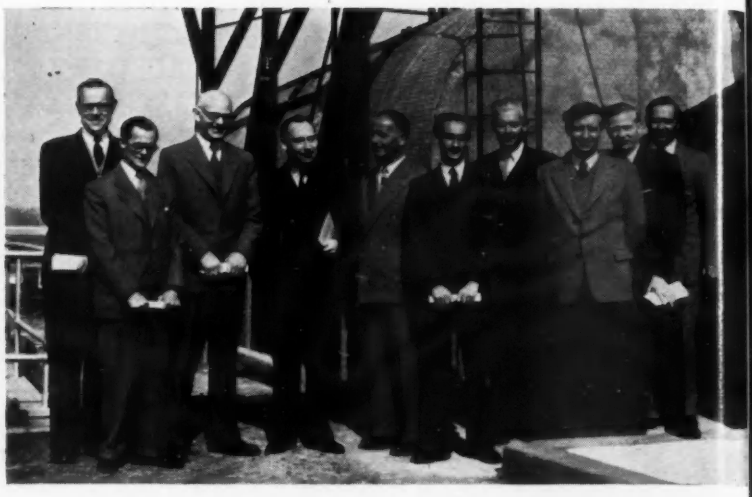
A visit was also arranged to Southampton gasworks (see p. 718), and this took place on Thursday. It will be remembered that the static vertical retorts at this works formed the subject of a paper presented to the meeting on Tuesday, May 24, by Messrs. Burgess and Neil, of the Southampton and District Undertaking.

Two other visits to works which may be considered as closely related to the gas industry were those to the Fawley Refinery of the Esso Petroleum Co., Ltd., and to the Totton Tar Works of the South Western Tar Distilleries. An

Two Northern Gas Board engineers being shown round Hilsea works.

A group of visitors to Hilsea pause for the camera.

Driver J. Haskett of the Southern Gas Board with trophies won in the 'Lorry Driver of the Year' contest sponsored by the Portsmouth Accident Prevention Council.



(Above, right and below right): Three groups of visitors to the Totton Tar Works of the South Western Tar Distilleries.

idea of the size of the Fawley Refinery may be obtained from our short description on p. 707. It is the largest oil refinery in the British Empire, and has an annual throughput of 7 mill. tons of crude oil. The Totton Tar Works are described on p. 711.

Among the other visits was one to the Eastleigh works of Pirelli General Cables Works, Ltd., where particular attention was directed to the latest methods of making flexible corrugated cable sheathings of aluminium and steel, which, it is claimed, could equally be used as ordinary pipes for carrying oils, gases, etc. The aircraft industry was also included in the list in the shape of the Airspeed Division of the De Havilland Aircraft Co., Ltd., at Portsmouth, where visitors saw the production of airframe components for aircraft. Large quantities of gas are used in the various heat treatments of the metals required. Other visits were to H.M. Dockyard, Portsmouth, the Eastleigh Locomotive Works of British Railways, Southern Region, the Woolston Works of J. I. Thornycroft and Co., Ltd., and last, but not least, to the Portsmouth Brewery of Brickwood & Co., Ltd.

Nor must we forget the arrangements made for the entertainment of the ladies—for the Institution had them well in mind with visits devised specially for their benefit. On Tuesday they went to the Naval Museum, Portsmouth, and for a tour of H.M.S. Victory. Afterwards they took tea at the Rock Garden Pavilion, Southsea, by invitation of Mrs. W. K. Tate. On Wednesday a ladies' visit was arranged to R.M.S. Queen Elizabeth in the Ocean Dock, Southampton, and on Thursday to the Portsmouth Works of Johnson and Johnson (Great Britain), Ltd., or to the Twilfit House Works of Leethams (Twilfit), Ltd. The Friday cruise and visit to Cowes was, of course, attended by both members and their ladies.

(Above and right): The ladies in a happy mood after Mrs. W. K. Tate's tea party at the Rock Garden Pavilion, Southsea.

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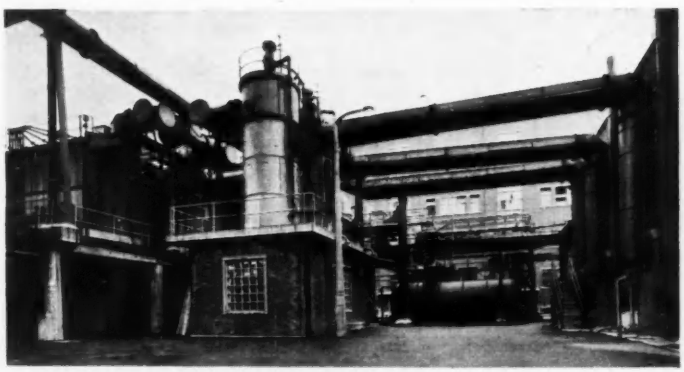

Photograph by courtesy of the North Thames Gas Board

The riveted steel mains shown in this illustration were erected by us at Bromley-by-Bow Gasworks

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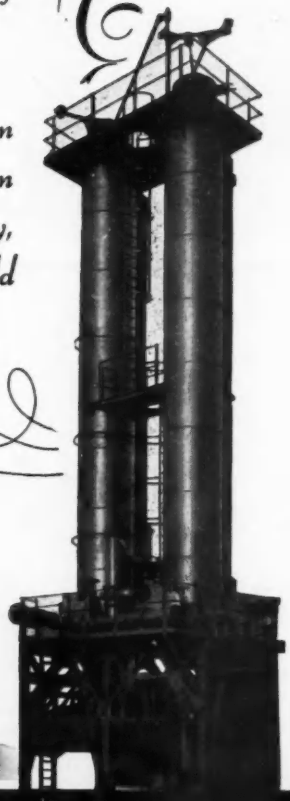

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Many New and Exciting Developments

Institution's New President Foresees Great Changes

Responding to the toast of the Institution of Gas Engineers at the President's luncheon at the Savoy Ballroom, Southsea, on May 24, MR. W. K. HUTCHISON, C.B.E. President-Elect, said many new and exciting developments were taking place in traditional or less traditional methods of gas-making, and undoubtedly we should see great changes in the industry from this cause alone in the next few years. However formidable the number of new processes and developments, there could be no standing still. The Institution would continue, as it had done in the past, to press forward vigorously seeking to overcome its difficulties by the exercise of technical skill and experience on the part of those who served it. He found among all the engineers a really new outlook, a sense that something new had to be found.

Political Feelings Aroused

Inevitably there was a tendency, when political feelings were aroused—as they had been, of course, in the nationalisation of part of their industry—to confuse an industry with those who worked in it, whether it be a company condemned for its private profits, a nationalised industry attacked because it was a form of organization favoured by one party, or even those primaeval examples of nationalised industry, the Navy, the Army, the Post Office, and the Tax Gatherers, all of whose methods and administration had almost been elevated to the realms of music hall jokes. Behind any one of those they would find people doing their job efficiently and well because it was a job which they knew how to do in an enterprise which they had created and which depended on them for its continued existence. 'We can proudly boast that no industry is better served than ours' said Mr. Hutchison.

The profession of gas engineering still offered great opportunities to those who had energy and enterprise for the formulation and execution of schemes as far reaching, bold and enterprising as any to be found in private industry. He hoped that when success was realized, as it would be, it would not be forgotten how much had been due to those whose lives had been spent in the industry, and whose affections lay there.

International President

The PRESIDENT, in proposing the toast of the guests, said it was a privilege to welcome the President of the International Gas Union, Mr. Robert W. Hendee, of Colorado Springs, U.S.A. Mr. Hendee in his outstanding career had not only achieved great stature in the American gas industry, having been President, in 1948, of the American Gas Association, but he had also received the Institution Gold Medal for a paper delivered in England in 1949. He wished him all success at the forthcoming meeting in New York of the International Gas Union. The Institution was dedicated to a profession that, in this country, served in the main one employer, and they appreciated the support they received from Sir Harold Smith, Chairman of the Gas Council, and an eminent predecessor in the Chair of the Institution ,and all his colleagues on the Gas Council, many of whom they were privileged to entertain. He wished to make especial mention of the Southern Gas Board and it Chairman, Mr. A. R. McBain, without whose unfailing confidence, help and assistance, he could not have discharged the duties of his office.

A Civic Welcome

The Lord Mayor of Portsmouth (COUNCILLOR G. A. DAY, J.P.), in response, said it was a joy to meet members of the Institution in Portsmouth, and all the guests would agree that everything seemed to have been done for their comfort. Everything seemed to have been done to make their stay in Portsmouth very welcome and very friendly and enjoyable.

MR. R. W. HENDEE, HON.M.INST.GAS E., President of the International Gas Union, in proposing the toast of the Institution, said it was indeed a wonderful pleasure for him to be here with them and to meet again so many of his very good friends in the Institution. As he had sat there and looked around, he had recognized so many people who meant so much to him as friends. He just could not tell them in words what friendship meant to him, and he was happy to be with them. He was also extremely happy to have that opportunity to speak a word about the Institution of Gas Engineers. He had a very warm spot in his heart for the Institution, not only because he had had the honour of being made an Honorary Member, but because he was the possessor of one of the Institution's Gold Medals. 'I want you to know that that medal, which was given to me in 1949, has been on my desk in front of me ever since that time, and I regard it as a tremendous honour,' said Mr. Hendee.

On Solid Foundations

The Institution, founded 92 years ago, was conceived even earlier, even as early as 1849, and it had had a long and glorious record of achievement. Its record was understandable when it was realized that it had been built on such firm rocks as that of being a technical Institution and sponsoring education and having as its other two pillars the accumulation and dissemination of technical information and the support and promotion of research.

From a perusal of the 92nd annual report, it was easily seen that progress had been made since the last annual meeting in every one of the activities he had mentioned, due to the splendid direction of the President, Mr. Tate, and the able guidance of that most efficient and amiable of Secretaries, Dr. Braunholtz, and the wonderful work and co-operation of all the committees. Of particular interest to him, because he was interested in seeing young people get a start in life, was the magnificent programme of education, embracing as it did those fine and successful Christmas Lectures for young people. Those lectures would certainly pay large dividends in encouraging young people to join the gas industry as a profession, and would help greatly in the public relations of the industry by educating young people in the problems of the gas industry. Their co-operation with, and assistance to, the International Gas Union had been greatly appreciated and had been excellent. Speaking of that organization, he extended to all a cordial invitation to attend the conference in New York City next September.

Pleasurable Anticipation

MR. W. K. HUTCHINSON, replying, said he was looking forward with many colleagues to visiting the United States and to attending the conference under Mr. Hendee's Presidency. He took the opportunity of adding to what the President had said and offering to Mr. Hendee his very best wishes for the success of that great conference. He would only tell him that from sitting next to him and hearing about it, from reading about it and knowing what he had laid on for them, there was no need for good wishes, but only pleasurable anticipation. International co-operation was a lively and important issue and they in the gas industry were playing their part in several ways. The gas industry throughout the Western world was going through a period of change which might well appear to later observers as fundamental as that which introduced gas piped through the streets of cities as a means of increasing comfort and well-being in the home. In the United States, a revolution had already occurred by the discovery of what appeared to be unlimited supplies of natural gas. Not content with piping it, they were planning to transport it in liquified form. Italy was already well on the way; France was beginning, and Germany had promise of appreciable quantities. How fortunate were those countries where the gas bubbled naturally from underground, like champagne compared with our home brewed bitter ale—and cheaper too, which was the hardest thing of all. However, hopes were high, and there were plenty of corners of England yet where successful borings might start a new era for us.

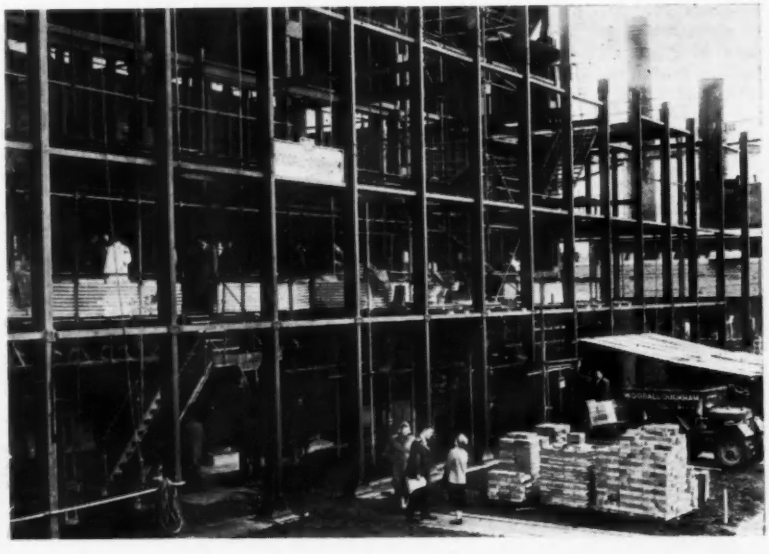
MR. A. R. MCBAIN, C.B., O.B.E., Chairman of the Southern Gas Board, proposed the toast of the President, and MR. TATE briefly replied.

CRUISE AND VISIT TO EAST COWES WORKS

'All Aboard.'

AFTER the glorious weather in which the first three days of the Institution Summer meeting at Southsea were held, it was rather disappointing that the Weather Clerk cast a cloud over the cruise and visit to Cowes arranged for Friday, May 27. Nevertheless, despite the weather, about 220 members and other visitors turned up for this trip by motor vessel through Portsmouth Harbour and the Solent to Cowes, where they arrived just after midday. Here they were entertained by the Southern Gas Board to lunch at the Central Gasworks, East Cowes, and afterwards were able to tour the works which is under construction. Among the main plant on view was the Woodall-Duckham carbonizing plant which, when completed, will comprise 30, 3¼ tons recuperative intermittent vertical chambers, having a total nominal carbonizing capacity of 245 tons of coal per day, giving a gas output of about 3½ mill. cu.ft. of mixed gas per day. Also seen on the tour was the wet purification plant which has been erected by R. & J. Dempster, Ltd., and designed in collaboration with the Southern Gas Board. When completed, this plant will comprise two condensers, a water cooling tower, Livesey and static washers, and an electrostatic detarrer, together with the various valves, connections and accessories. Later in the afternoon the party re-embarked at Cowes for a cruise in Southampton Water and the famous docks, where a number of ocean-going liners and other vessels were to be seen; during the course of the cruise, tea was taken on board ship.

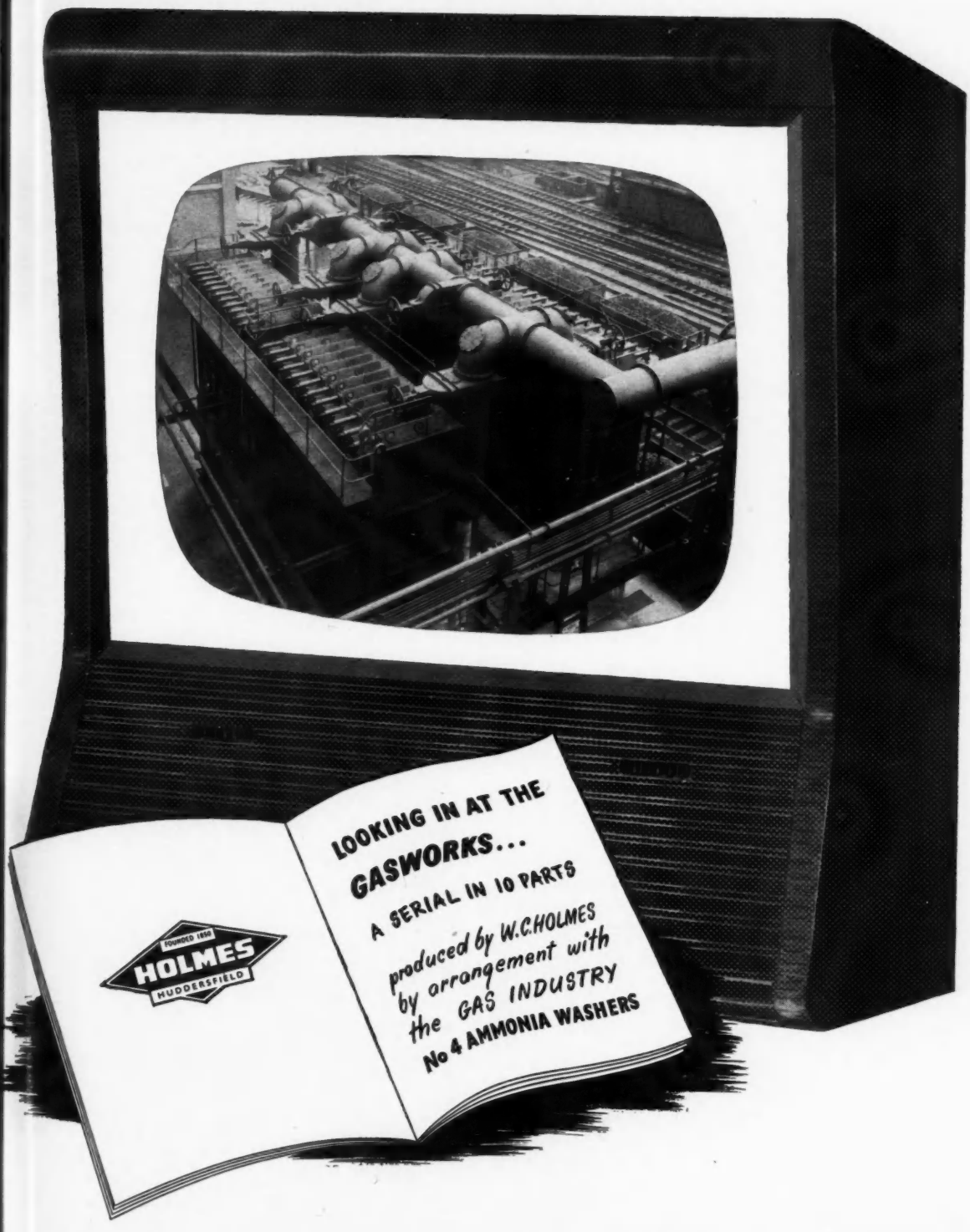
P. F. Smart explains a knotty point to one of the visitors.



(Above) Bernard Clarke, Divisional General Manager, Lincolnshire Division, East Midlands Gas Board, and H. S. Cheetham, Director, Woodall-Duckham Construction Co., Ltd.

(Left) During the tour of the Woodall-Duckham retort house which is in course of erection.

Commercial T.V. with no apologies



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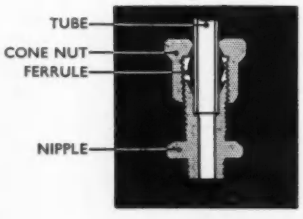

serving to burn

Note: the four burner heads (right) are for high pressure gas, or low pressure gas and air blast.

LEFT: "Fishtail" type burner with two-armed stamped pattern injector for heating liquid in tanks by submerged combustion tubes. For use with low pressure gas supplies.
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